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# The INTERNATIONAL JOURNAL OF ORTHODONTIA

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# The International Journal of Orthodontia

*Editor: Martin Dewey, D.D.S., M.D.*

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## ORIGINAL ARTICLES

### SOME CONSIDERATIONS REGARDING THE MOST SUITABLE AGE FOR THE TREATMENT OF CERTAIN FORMS OF MALOCCLUSIONS

BY AXEL F. LUNDSTRÖM, D.D.S., STOCKHOLM, SWEDEN.

THE question as to what age is the most suitable for the treatment of malocclusions of the teeth has been answered from two different points of view. If we judge from the professional literature on this subject it seems apparent that the school of the Occlusionists has proved victorious. As is well known, this School was founded by Angle, whose doctrines soon attained a dominating influence on our literature and possibly also our practice. This school asserts that normal occlusion is the ideal from the masticating standpoint as well as the esthetical. They claim an early treatment is always preferable, and should a facial disharmony arise as a consequence of the correction of the malocclusion, it will in time disappear during the further development of the face.

The other doctrine or school, which may be called the school of Dentofacial Orthopedia, has in some respects a quite different view concerning this phase of the subject. One of the teachings of this school is, that a denture, that has developed with the teeth in a most normal occlusion, may so interfere with the harmony of the facial lines that it is most desirable to correct this inharmony by means of an orthodontic treatment. C. S. Case, the founder of this doctrine, states that in a number of cases it is impossible to predict the facial type at an early age,[1] so it will be necessary to postpone the definite treatment until a later age than that considered advisable by the occlusionists.

As a general rule, the early treatment of the occlusionists seems the most rational, yet there are a few types of malocclusions, where a relatively late treatment is preferable. These cases have certain characteristics, that remind us of the problems of facial orthopedia. One of these is that it is possible only at a later stage to form a definite opinion of the true nature of the anomaly.

Another reason for postponement of treatment is that in certain cases the insufficient development cannot be sufficiently stimulated by mechanical means, unless it be accompanied by the correction of the permanent teeth. Certain varieties of mesioclusion and open bite have the former characteristic, opistognathy the latter.

It has long seemed to me a significant fact that we so seldom find in our literature records of treated cases of Angle's Class III. And it is still more rare to find the history of these cases several years after the treatments were finished. It seems highly improbable that those operators who feel it their duty to relate results of their work consider Class III cases as not of sufficient importance to be described. Is it quite wrong to conclude that difficult cases with good results are comparatively rare? But if we have studied the nature of these cases our unsuccessful results will not astonish us.

The variety of Class III malocclusion I have in mind is *progenie,* popularly, I believe, called "jimber jaw." It is characterized by an abnormally large growth of the mandible. Regarding the treatment of these cases, it has long been known that if it is postponed until a certain stage, they cannot be corrected by orthodontic means alone. But it also appears to be a prevailing notion among orthodontists, that if treatment is started at an early age the tremendous growth of the mandible may be prevented.[2]

For several years I have been convinced that this idea is erroneous. In cases of jimber jaw, the growth of the mandible is, at least to a very great extent, independent of the occlusal relations.* If this is not the case, how is it possible to account for a mesial malocclusion of a width of two bicuspids? If an interdigitation could prevent the forward, it ought to have occurred when the malrelation was the width of one bicuspid. A treatment that is finished before the relation between the upper and lower jaws has become definite will consequently only be a temporary improvement. If an early treatment of a Class III case has a successful and permanent result, it only proves that the particular case was not a case of progressive progenie.

In an excellent article Kantorowicz[3] has proved the hereditary character of progenie. By means of reproductions of portraits of members of the Hapsburg family he has shown how this anomaly has dominated in this family during several hundred years. With this in mind, it will certainly not astonish us if we are unable to combat this excessive tendency to abnormal growth of the mandible. It is therefore logical to postpone the final treatment until the abnormal mandibular growth has subsided. As soon as we find the mandible in a stationary relation to the upper jaw it is time to take into consideration the orthodontic treatment, in which case we should aim at a forward movement of the upper teeth. Attempts to influence the mandible with the chin cap or intermaxillary force have, it appears from our literature, not had the expected results. Nor has the method of extracting two bicuspids in the lower jaw and moving backwards the six anterior teeth been successful.[4] This is not astonishing, as the size of the mandible *in these cases* is determined by an abnormal

*It is a well-known fact that the growth of the mandible generally is perceptibly disturbed by the early loss of the first permanent molar. In cases of progenie the mandible grows independently, or at least relatively independently of early losses of these teeth.

growth of the body of the jaw and not by function; it would therefore be very strange if an extraction of teeth could obliterate this tendency.

As there are mesioclusions of every degree that have never been treated, it is evident that many of them could have been corrected with a permanent result, provided the treatment had been finished after the tendency to mesial movement had lost its activity. At present it appears to me to be impossible to decide, on the basis of a single examination, whether a case is of the progressive variety or not. As suspected symptoms I would suggest abnormal spaces between the lower permanent incisors. Another suspected symptom is when the apical arch of these teeth is large as compared with the coronal arch; yet another is a raising of the occlusion which results in an infraocclusion of the temporary molars. These three characteristics may be symptoms of an abnormal mandibular growth. If we find any of these symptoms in a Class III case we may suspect a case of progressive "jimber jaw." It would indeed be

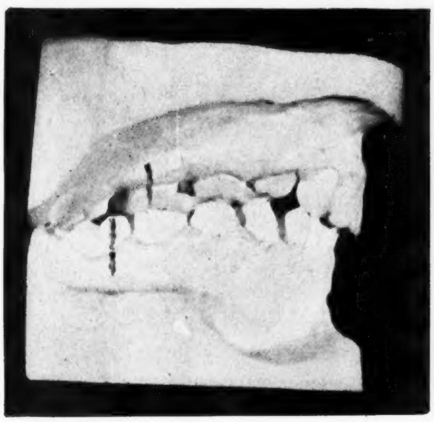

Fig. 1.

very unwise to start treating a case like this without previously having informed the patient of the progressive nature of the deformity.

To better illustrate this it will be appropriate to discuss some cases from practice. Fig. 1 shows us the models of a case of a patient about nine years of age. It was treated without further delay and after six months the mesio-distal relations were corrected, and retainers with intermaxillary rubbers were placed in position. The patient was more or less under observation until all the deciduous teeth had been lost or extracted. Fig. 2 shows the condition present about three and a half years after the beginning of the treatment. The lower jaw had advanced considerably. The upper incisors were still occluding in front of the lower ones, but the considerable movement of the lower jaw had given the upper incisors a very slanting position. It was, therefore, necessary to again start treatment, and the occlusion one year later is shown in Fig. 3. No change in the mesio-distal relations could be detected one and a half years after the use of the intermaxillary elastics was discontinued. This case has been under more or less treatment during five and a half years, and I am convinced that the final result would not have been worse if the first treatment had been delayed a couple of years, or until the time of the shedding of

the last temporary teeth. Conditions present at the time of the first visit of the patient, which should have made the operator apprehend a progressive case, were the raising of the bite (see Fig. 1) that put the deciduous molars out of function, and finally the hereditary character of the anomaly, which could be traced back some one hundred and fifty years.

Fig. 4 is a case with a progressive tendency. The large apical arch of the lower teeth gives reasons to suspect this. An immediate treatment was, however, desirable on account of the insufficient space for the right superior

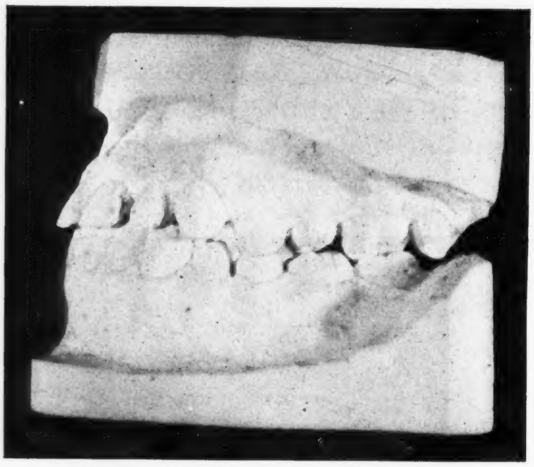

Fig. 2.

Fig. 3.

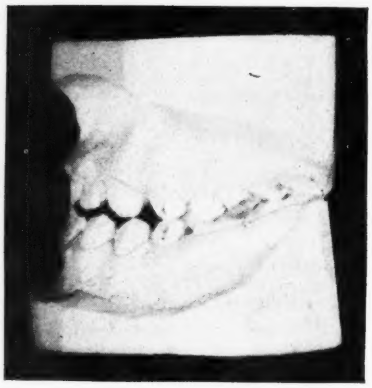

Fig. 4.

cuspid. Fig. 5 shows the case at the time of fixing the retainers; Fig. 6, one and a half years later; Fig. 7, another year later; and it is quite clear from the raising of the bite and the forward movement of the lower teeth, that the mandible, which is abnormally large as compared with the upper jaw, is in a state of forward growth.

Fig. 8 is a case of mesioclusion. The age of the individual was eight years, but as the abnormal spacing in the lower jaw seemed to indicate a progressive case, making a facial-orthopedic problem, the treatment was postponed until the remaining deciduous teeth had shed. The treatment was started two years later (Fig. 9); at this stage the tendency to abnormal growth, was

clearly discernible in the opening of the bite. The temporary molars, which previously had occluded sufficiently to grind them flat, were then in infraclusion. All the benefit that could have been effected at eight years can with all probability be effected at ten, the difference being that the patient is spared the wearing of appliances during these two years. It is not at all improbable that the mandible may still be in a state of abnormal growth; but the time for starting treatment was decided upon because of the necessity of gaining space for the unerupted upper permanent teeth; that is to say not because of Class III

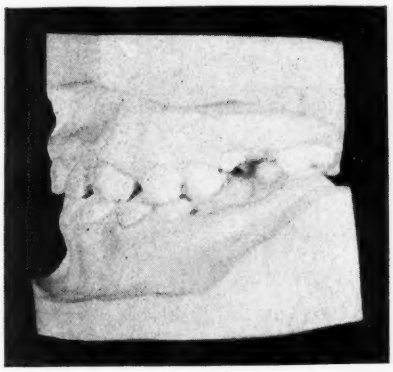

Fig. 5.

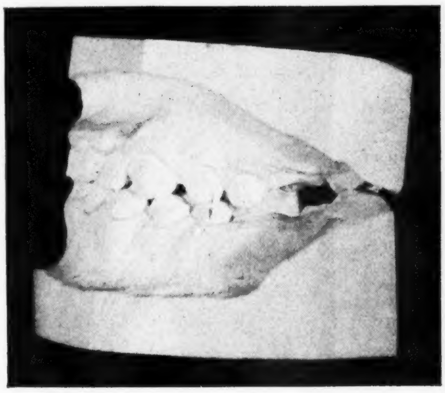

Fig. 6.

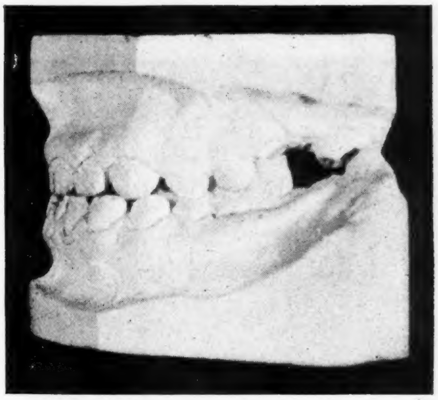

Fig. 7.

characteristics, but for the sake of correcting an abnormality, that may be found in all the three classes.

What has been said regarding the choice of age for treating progenie may also be applied to certain forms of open bite. Lind[5] has elaborately described the nature of these anomalies, and proved that they often are developed in connection with the eruption of the second permanent molars. It is therefore logical to have this circumstance in mind in prognosing the case and deciding on the time for starting treatment.

As has been stated above, we find in certain cases of mesioclusion and open bite an abnormal development of the mandible, which abnormal growth may be in operation during a long period, thereby frustrating our results if they have been attained before this abnormal tendency has ceased to be active. In

these cases a very early treatment is to be avoided. There are also a few other forms of malocclusion, that are better treated at a comparatively late age, but for quite different reasons.

In one of these forms there is a deficient development of that part of the upper alveolar process that contains the incisors, or the os incisivum. This deficiency is often found combined with other malocclusal factors, but when it is the only one it generally gives a sunken appearance to the upper lip. It seems to me that we should in our nomenclature for these cases use the old name opistognathy, as has recently been done by Greve.[6] As a general rule the treatment of opistognathy is a very slow proceeding, in which respect it dif-

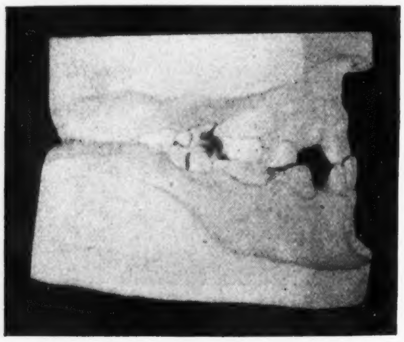

Fig. 8.

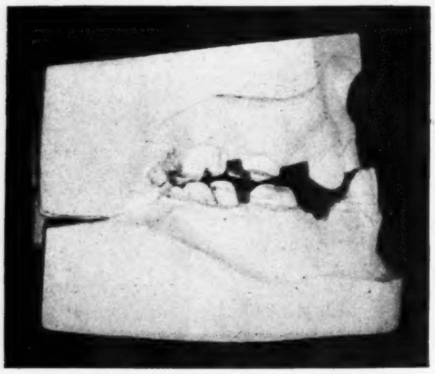

Fig. 9.

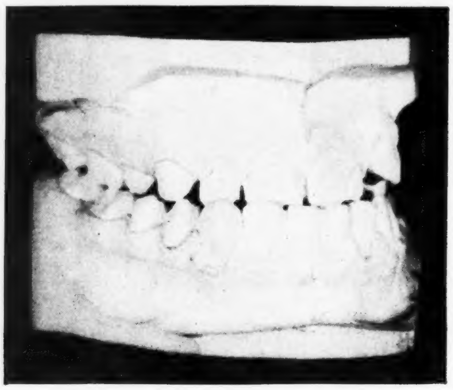

Fig. 10.

fers radically from those cases of Angle's Class I, where the whole treatment consists of a simple moving of the upper teeth from lingual occlusion, which operation is said to have been effected in a very few weeks. Examples of this latter type have been published by Angle[7] and Dewey.[8]

To a superficial observer these cases are somewhat similar to opistognathy. One case that has been published in several editions of Angle's textbook, among others, in the seventh American edition, Fig. 352, and in the second German edition, page 507, Fig. 468, is a case of true opistognathy. Angle mentions this case as an example of the results of the early loss of the temporary cuspids. Of course, such a cause may have been active in this case, but the dominating factor in this case is the deficiency in the development of the intermaxillary bone,

which is also testified by the author, who makes special mention of this fact. This same deficiency may be found where the temporary cuspids were shed at their normal time (see Fig. 14). Figs. 10 and 11 are cases of opistognathy, in which the deficient development of the intermaxillary bone was the only anomaly, the occlusion being otherwise practically normal. In Figs. 12 and 13 there is other malocclusion. As a general rule the upper incisors occlude inside the lower ones, but an exception is shown in Fig. 14.

The treatment of a case like Fig. 10 would appear rather simple to the

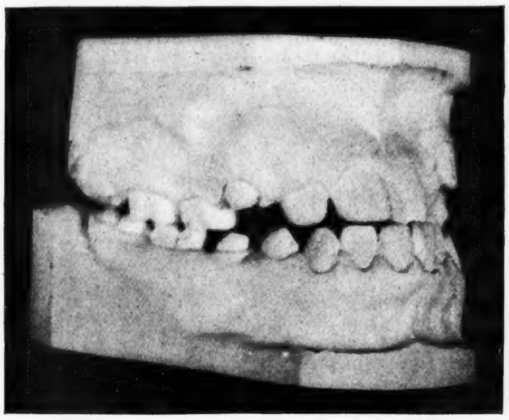

Fig. 11.

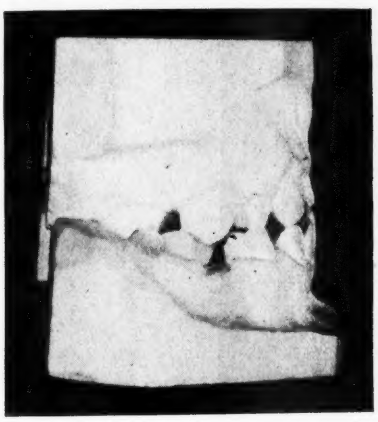

Fig. 12.

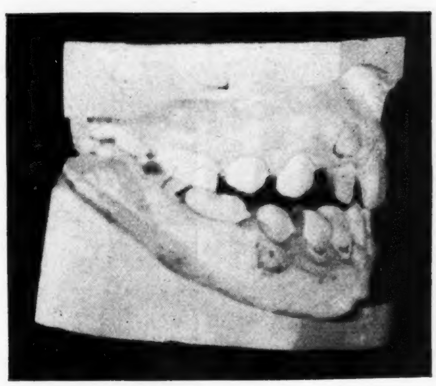

Fig. 13.

superficial observer, as it would seem to be confined to moving the upper incisors into normal occlusion, thereby making sufficient space for the cuspids. This impression would be strengthened by descriptions of the treatment of cases of *apparent* opistognathy, like Angle's case mentioned above, that was finished after several weeks' treatment, no artificial retention being required. Instead of this, the movement of the malposed incisors in cases of true opistognathy is a very slow and tedious undertaking, and according to my experience, the bone development in the apical region after the treatment is not as great as is desired, even when the treatment is begun at a very early age. If we start treatment any considerable time before the permanent cuspids have erupted, the chief

difference will be a longer period of wearing appliances. If, however, the deficiency of the alveolar process is so considerable as to prevent the laterals from erupting, it is, of course, necessary to remedy this by an early expansion. But if conditions are relatively favorable, as shown in Fig. 13, a late treatment will save much time, and the final result will be the same. When I say late treatment, I mean, that instead of beginning as soon as the malocclusion can be detected, or about the age of seven, we ought to wait until the permanent cuspids are ready to erupt.

The history of the case shown in Fig. 12, may serve to illustrate the length of time the treatment of a case like this will consume if started early. During

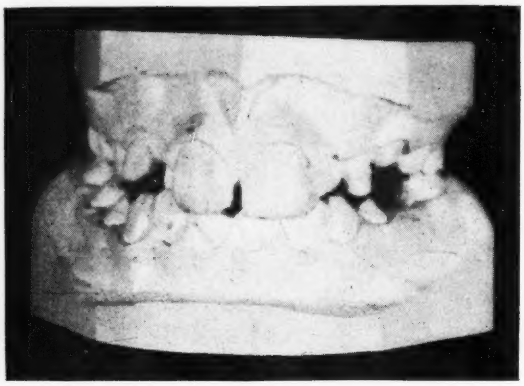

Fig. 14.

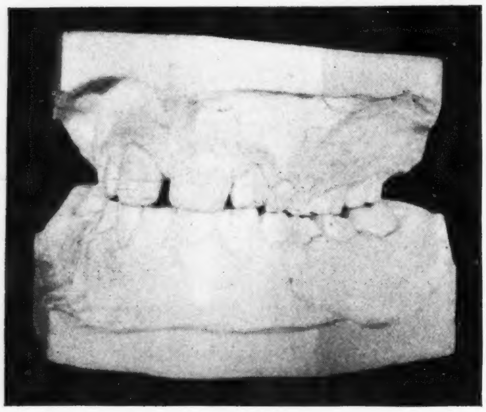

Fig. 15.

four different periods the patient was wearing expansion arches, which, together with the final retention, gives a term of 5 years during which the patient was under orthodontic treatment. It seems probable, that if the treatment had been postponed a year or so, the final result would not have been worse.

The time of active treatment of the next case (Fig. 13) was one year. The patient was then 12 years, and it seems to be very clear, that if the treatment had been begun as soon as the malocclusion became apparent, which must have been four or five years earlier, the whole difference would have been that the patient would have been kept so much longer under treatment.

What has here been stated regarding the proper age for treatment of opistognathy can also be applied in certain respects to many cases with deep and narrow palatal vault, although the *possible* chances of broadening a narrow nasal space would justify an early expansion of the dental arch. I will, however, relate a case history, in which apparently the early treatment only lengthened the time of the orthodontic attention. The patient was 11 years. The palatal arch was very narrow and deep. The upper incisors slightly prominent and the lower arch in slight distal occlusion (Fig. 15). The width of the lower jaw was apparently normal. The patient had undergone operations in the nose and throat several times.

The upper arch was expanded and the other occlusional defects corrected. In spite of this, the upper bicuspids erupted in lingual occlusion. This necessitated a new expansion. The treatment was stretched over a considerable length of time, being prolonged by a circumstance which appears to be the rule in cases like this; namely, the delayed eruption of the upper permanent cuspids and bicuspids compared with the eruption of the corresponding teeth of the lower jaw.

It is interesting to note that the rhinological examination after the first expansion of this case revealed an abnormally narrow nasal space and a septum that was deflected, not in a superior-inferior direction, as would be expected, but in an antero-posterior direction.

The high and narrow palatal vault is often accompanied by other malocclusal details; as distoclusion, prominent incisors, and deep overbite. If this is the case the treatment ought to be begun as early as is desirable for these details.

We often find in our literature statements that to the mechanical expansion of the arch can be attributed divers remarkable effects on the nasal space. Some authors claim that broadening of the nasal space and straightening of the deviated septum is the direct result of the widening of the dental arch. This is, however, not yet scientifically proved. Cryer and Ottolengui have published cases in which an extreme narrowness of the nasal space was accompanied by palatal arches of fully normal width. These cases prove that the width of the nasal cavity and oral arch do not necessarily depend on the same cause. I have, myself, seen many cases of very deep and narrow palatal vaults, in which early mechanical expansion combined with early nose operations were still followed by a leptorhinical condition. The result of the expansion was chiefly *dental* and only, if at all, in a lesser degree *naso-palatinal.*

It is not necessary to here discuss those objections which may be raised in consequence of the observation that an expanded temporary denture may be followed by a broader permanent arch. The most of us have doubtless observed that this may often happen with an abnormally narrow arch that has never been expanded by mechanical means; and also, that an expanded temporary denture may be followed by a permanent arch with the distance between the bicuspids shorter than it was between the temporary molars immediately after the expansion. In accordance with these facts it seems as if we are justified in considering the lateral expansion of a contracted upper arch as a facial-

orthopedic operation and consequently delay the expansion until the bicuspids are erupted, always provided that there are no *other circumstances* that demand an earlier orthodontic treatment.

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# DENTAL ENGINEERING: EXACT ORTHODONTIA

By Rudolph L. Hanau, Consulting Dental Engineer.

IN introducing Dental Engineering to the readers of the *International Journal of Orthodontia* in my article of Vol. II., No. 9, I indicated that I would publish from time to time my findings and results of investigation. That I have not had much to write for publication since is not due to a lack of valuable information. The basic principles of Dental Engineering are contained in a paper "The Hawley Arch Form Method Considered From an Engineering Standpoint and a Scientific Substitute," read before the Pittsburgh meeting of the American Society of Orthodontists, July 22, 1916. I stated in my first article in this Journal in September, 1916, that I would await the publication of that paper in the Society's organ before bringing any new material before the profession, as an understanding of the basic principles contained therein is necessary for the proper understanding of any new material. To my regret, that paper has as yet not been published, but I shall quote from it in this and later articles whenever it seems helpful to an understanding of the subject.

The practice of orthodontists and prosthodontists to produce a dental arch form to conform with certain geometrical figures may be justly described as an effort to make the foot fit the shoe.

The geometrical properties and mathematical proportions of objects in nature have always been, and correctly, used to classify them in all natural sciences, particularly in biology and mineralogy. However, to attempt to find, and dogmatically believe in a constant geometrical relation, where none exists, is not only unscientific but intolerable.

The problems in connection with the dental arch form are such that they must be solved on their particular merits.

The case against the Bonwill arch was summed up in the Pittsburgh paper as follows:

"The Bonwill arch and the Hawley method of construction, * * * * * which have served a purpose in orthodontic work, are based on the assumption that the anterior teeth are arranged on the arc of a circle having a radius equal to the sum of the mesio-distal diameters of the central, lateral, and cuspid. In exceptional cases this method fits, in some cases it very closely approximates the actual requirements. In most cases, upon investigation, we find that the practice of using the dimension of the three anterior teeth as the radius of the circle is absolutely erroneous.

There are two predominant factors in the determination of the dental arch form viz.,

1. Width of the C. C. Curves at the second or third molar.
2. The degree of the overbite (deep, shallow, and end-to-end).

The occlusal relation of the bicuspids and molars with their opponents is comparatively simple on account of the interdigitation of the cusps. Through them the exact distance between the upper and lower C. C. Curve is fixed. A change in the radii of curvature of both C. C. Curves will bring both upper and lower into their proper occlusal relation. A small variation may be obtained by rotating these teeth. The most difficult problem we are confronted with is the overbite. It is possible to arrange the anterior teeth on different and differently related C. C. Curves and yet comply with our known rules of occlusion—mechanically and kinematically at least. This is so because the accepted rules of occlusion involve too many unknown variables of physical and physiological character. It has been accepted that teeth are held in their position by forces of occlusion and these forces are defined as those factors which cause the teeth to assume and maintain their proper position in the line of occlusion. Quoting from one of the best texts on the subject—Dewey's "Practical Orthodontia"—these forces of occlusion are:

1. Normal cell metabolism.
2. Muscular pressure.
3. Forces of inclined plane.
4. Normal approximal contact.
5. Harmony and size of arch.
6. Atmospheric pressure.

In the determination of the dental arch, I will frankly admit that I only consider these factors when manifested as physical conditions, for the reason that I have not yet found anybody who could give me their definite value, not to speak of their definite interrelation.

Furthermore, the manifestation of any or all of these factors should not influence too much the regulation of the teeth, since our understanding of the interrelation of these factors is so meager.

In normal dentures and in cases of "set malocclusion,"* where conditions have become permanent, all of these forces, assuming their existence, are in

*By "set malocclusion" is meant those cases of malocclusion in which the teeth have become locked in positions of malocclusion by the various forces of occlusion.—Editor.

equilibrium; i.e., the sum of horizontal and vertical forces and moments equate to zero.

$$H = 0$$
$$V = 0$$
$$M = 0$$

In the case of "set malocclusion," it is the problem of the orthodontist to find a new equilibrium, by positioning the teeth in such a manner, that the disturbing influences on neighboring bone and tissue will be eliminated; i.e., compliance with physiological requirements.

Our vague understanding of the interrelation of the forces of occlusion accounts for the many disappointing observations when releasing retention. The teeth often "slip right back," even if retained for an apparently sufficiently long time. When this occurs, we have sufficient data to determine the reaction of the forces that have caused the "slip" and we can logically revise the arch form to meet the physically manifested conditions. It will also be well to check up the original survey and proposed arch form, and to change the C. C. Curves to accommodate the new findings.

Thus, since in the determination of the arch as far as the occlusal relation is concerned, one and the same set of teeth may be arranged on several arch forms, the problem of the orthodontist becomes one of geometrical, kinematical and mechanical considerations.

The orthodontist of today, lacking a knowledge of these essential aids of orthodontia, resorts to extended trial and error methods and "good judgment," and pins his faith to machines, appliances and empiric formulas. It is really very fortunate that, often, good results are attained by these methods. However, even in the successful cases, the work is uncertain and of "cave-man erudition;" and often extends over a period of several years.

The constant quest for machines to supplant logical analysis by orthodontists is well exemplified by a personal experience of the author.

When a dental surveying apparatus which I invented was brought on the market, some commercial genius spread the tale that the apparatus determined the occlusion of the teeth. Since then, I have applied for patents for an "Apparatus for Determining the Occlusal Relation of Teeth" and a very similar machine has been offered to the profession by another party. Both apparatus are useful for demonstrating and similar purposes, but they cannot be used for the determination of accurate occlusal relation of the teeth.

If it would be possible to classify our patients as belonging to a certain race or family among whom certain arch forms predominate, then it would be comparatively an easy matter to use such data for selecting a possible arch form nearest to the type desired by simply computing the tooth material on hand.

The writer has good reasons for believing that the different types of arch forms, found among the different races, types, sexes, and other classifications are mainly due to the ratio of the lower to upper anterior tooth material and the depth of the overbite.

There also exists, without doubt, a definite relation between the shape of the skull and the dental arch form. To establish this relation, the writer

proposes that measurements also be made of the posterior teeth and their relation to the rise of the posterior ends of the C. C. Curves, the latter probably being a factor in the development of the bone.

Very early in my investigations, I have found that a lateral widening of the posterior ends of the C. C. Curves is equivalent to a raising of the posterior ends of the C. C. Curves. This finding would indicate that the occlusion of the same set of posterior teeth may be obtained by narrowing, and simultaneously raising the posterior ends of the C. C. Curves or by widening and simultaneously lowering the posterior ends of same curves.

Another method of changing the arch form, without interfering with the occlusal relation, is moving an entire region bodily or rotating it around an axis or both, simultaneously or successively. This applies to any particular region of the denture, or to the denture as a whole. When rotating or bodily moving one region only, the influence of such procedure on the neighboring regions must be very carefully considered.

When speaking of bodily moving, or revolving any regions, it is assumed that the relation of the individual teeth or their axes to the C. C. Curve has not been interfered with. If we also change the relation of the axes of the teeth to the C. C. Curves, another complication arises. When the molars and bicuspids are thus concerned, it will be observed that the inclined planes of the cusps assume abnormal contact and an error, therefore, will immediately be apparent. The rotation of the anterior portions of the C. C. Curves with the teeth around a common axis does not alter the relation of the individual, adjoining, and opposing teeth within the region. Revolving the C. C. Curves in their anterior portion, and moving the teeth bodily only, involves a pronounced change of the occlusal relation of the anterior teeth. A similar result obtains when rotating the teeth around their mesio-distal axis without changing the C. C. Curves. These factors encompass the problem of the overbite. A later article will be devoted to a more elaborate presentation of these intrinsic facts.

# HISTOLOGICAL STUDIES OF THE DEVELOPMENT OF THE ALVEOLAR DENTAL LIGAMENT OF YOUNG RHESUS MONKEYS

By F. Hecker, B.S., D.D.S., A.M., M.D., Kansas City, Mo.

*Director of Research Laboratory of the Dewey School of Orthodontia, Kansas City, Mo.*

HISTOLOGICALLY the alveolar dental ligament and the periosteum of the alveolus are alike. The author does not believe that without knowing the location of the field microscopically one can differentiate these tissues. A careful examination of slides in the author's possession which are longitudinal sections, reveals no line of differentiation between the alveolar dental ligament and the periosteum, but instead shows that the periosteum and the alveolar dental ligament of the deciduous tooth are histologically the same. In addition to this observation, one also learns from the slides that the fibrous capsule which surrounds the developing tooth is also a tissue of the same type as the periosteum of the alveolus.

Anatomically let us trace the periosteum in its course from the alveolus. At the gingiva of the tooth, we observe that the periosteum passes across the space between the alveolus and the neck of the tooth and that some of the fibers of the periosteum are turned downwards. Directly below the gingiva we find the alveolus and the fibers of the alveolar dental ligament in this area take on a definite angle and this angle is maintained practically to the apical area of the root of the tooth. In the actual apical area of the root of the tooth are the fibers of the alveolar dental ligament; although some are attached to the root of the tooth, many of them are parallel to the root of the tooth and occasionally we note a bundle of fibers projecting out in the immediate alveolus.

Continuing our study of the alveolar dental ligament we learn that some of the fibers of the alveolar dental ligament in the apical area of the deciduous tooth unite with the fibrous capsule of the permanent tooth. Thus, by this union of the fibers, we practically have a continuation of the fibers of the alveolar dental ligament of the deciduous tooth with the fibrous capsule. Just at what time the union takes place the author does not know and further it is not necessary, for this paper is not dealing in the early embryonal stages of the development of the alveolar dental ligament. Anatomically, the alveolar dental ligament is ligamentous. Other functions which the alveolar dental ligament possesses are that it is one of the avenues of vascularization of the alveolus in the area with which it comes in contact and it is also one of the avenues of vascularization of the cementum of the root of the tooth. From the foregoing statement the reader must not infer that the alveolar dental ligament is the only avenue of vascularization of the alveolus or the cementum; for the author does not believe it is. In addition to the foregoing functions of the alveolar dental ligament, it has the same role to the alveolus forming the root socket as the periosteum has for the bone; namely, that it is a limiting membrane for the alveolus. Likewise, the alveolar dental ligament is a limiting membrane for the limited bony covering of the root of the tooth.

Let us now commence the study of photomicrographs that show the root of the deciduous tooth, the alveolus, the alveolar dental ligament, the cementum, and the relative position of the cusp of the permanent tooth to the root of the deciduous tooth. In Fig. 1, at 1 is shown a Haversian canal of the alveolus; 2, the alveolus; 3, the alveolar dental ligament; 4, the dentine; 5, the cementum; 6, the alveolar dental ligament covering the absorbing area of the deciduous root. At 7 is shown an area at which there is a separation of the fibrous capsule which surrounds the developing tooth; 8 shows an area, which, prior to decalcification, was partially occupied by the enamel of the crown of the developing tooth; 9 shows a small portion of the lymphoid pad and fibrous tissue which approximately


Fig. 1.—Showing the relative position of the root of the deciduous tooth and the crown of the permanent tooth and all of the immediate dental tissues.

covers the cuspal portion of the developing tooth; 10 is one of the cusps of a permanent premolar.

This picture shows very excellently the position of the alveolar dental ligament of the deciduous tooth and also shows the position of the alveolar dental ligament covering the end of the root, and at 7 is shown the fibrous capsule which surrounds the developing permanent tooth. The fibrous capsule which surrounds the developing permanent tooth unites with the alveolar dental ligament of the deciduous tooth; for evidence upon which this statement is made, see Fig. 6 at 7, and also Fig. 8 at 3. Thus by this evidence with the low power of magnification, we learn that in the process of the development of the permanent tooth and the absorption of the deciduous tooth, the alveolar dental ligament and the periosteum

of the alveolus are continuous. To substantiate this statement, let us now study Fig. 2.

In Fig. 2 we observe at 1 the alveolus, at 2 a continuation of the fibrous capsule that surrounds the developing tooth, at 3 is shown the columnar epithelium covering of the fibrous capsule that faces the enamel of the tooth, and at 4 three Haversian canals are shown. This picture shows us the continuation of the same type of tissue as the periosteum of the alveolus of the alveolar dental ligament that surrounds the root of the deciduous tooth. Let us now continue our study of the fibrous capsule which surrounds the developing tooth in the next picture (Fig. 3) which shows the future gingival attachment of the alveolar dental ligament at the neck of the tooth.

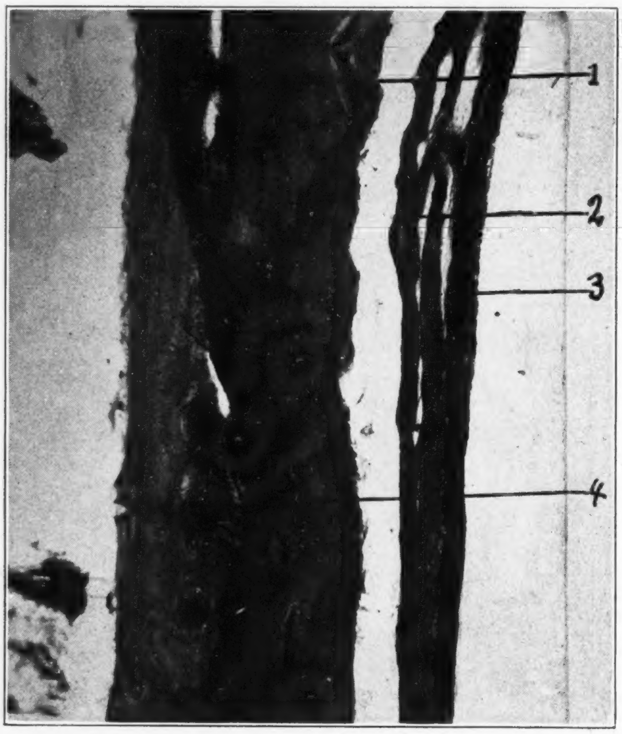


Fig. 2.—Showing a continuation of the fibrous capsule surrounding the developing tooth that eventually becomes the alveolar dental ligament.

Beginning at 1 in Fig. 3 is shown the alveolus, directly below the pointing line 1 is shown a Haversian canal. At 2 is shown the further continuation of the fibrous tissue of the fibrous capsule; at 3, the columnar epithelium covering of the fibrous tissue of the fibrous capsule which faces the enamel area of the developing tooth. At 5 is shown the incomplete attachment of the alveolar dental ligament of the future neck of the tooth of some of the fibers of the fibrous tissues composing the fibrous capsule. Lying directly to the left of this area one notes other fibers of the fibrous capsule which have separated from the bundle of fibers noted at 5. At 6 is shown the dentine of the tubuli standing out in bold contrast. At 7 the odontoblasts are distinctly shown, and at 8 the blood vessels of the pulp of the tooth are shown.

This picture shows very nicely the relative position of the fibrous capsule of the developing tooth which surrounds the crown, and its position at the future


Fig. 3.—Showing the fibrous tissue of the fibrous capsule, the columnar epithelium, and the future neck of the tooth, and the attachment of some of the fibers of the fibrous capsule.

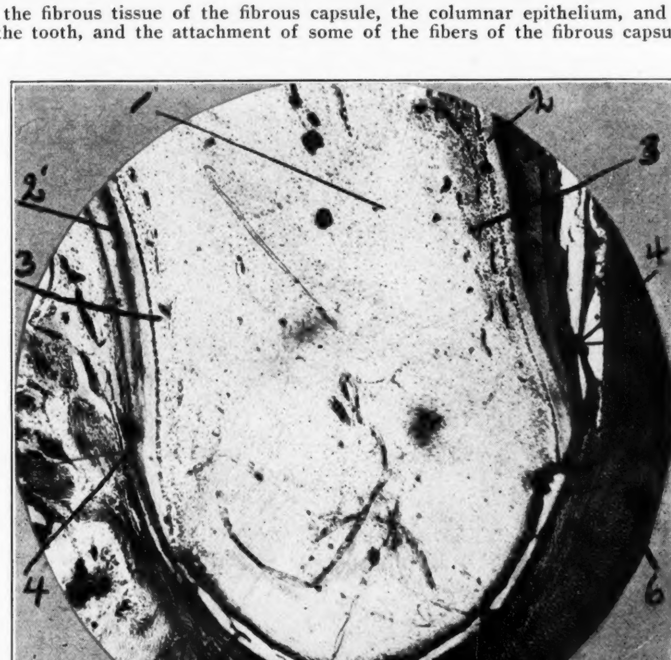


Fig. 4.—Showing the apical area of a developing root of the tooth and the immediate dental tissues.

neck of the tooth. Histologically this tissue is the same as the periosteum of the alveolus or the alveolar dental ligament which surrounds the root of the deciduous tooth.

In the next picture, (Fig. 4) is shown the extreme apical area of the root of a developing premolar. Beginning at 1 the pulp of the tooth is shown; 2 and 2′ are the dentine; 3 and 3′ show the odontoblasts; 4 and 4′ show the fibrous capsule surrounding the developing root, and at 5 and 5′ the fibrous capsule at the extreme apical area of the developing root of the tooth; 6 is the alveolus.

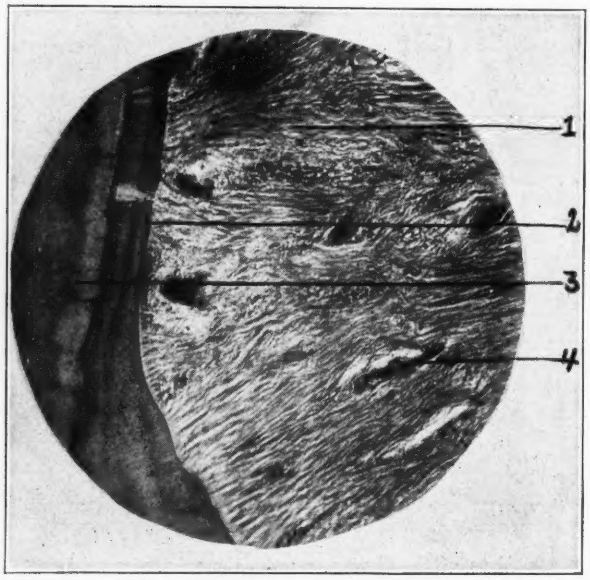


Fig. 5.—Showing the fibers of the periosteum and alveolar dental ligament.

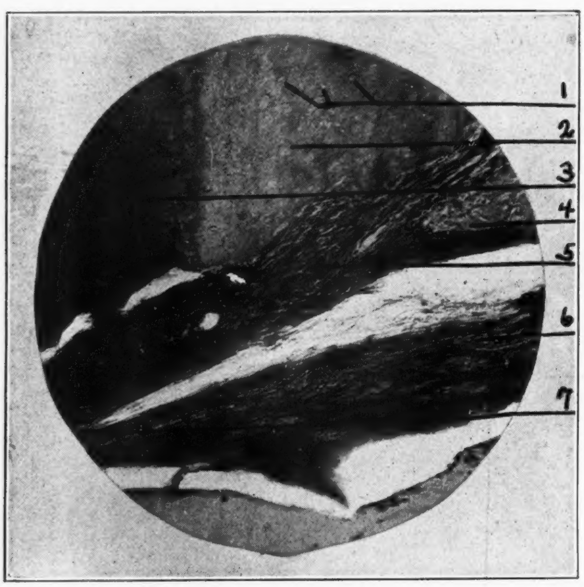


Fig. 6.—Showing the point of union of the alveolar dental ligament and the fibrous capsule which surrounds the developing permanent tooth.

This picture shows that the alveolar dental ligament and the fibrous capsule which surrounds the developing tooth are continuous to the extreme apical area of the developing root of the tooth. Thus, from the foregoing pictures, we learn that the periosteum covering the alveolus is continued at this time in the develop-

ment of the root of the tooth in the young rhesus monkey to the apical area of the developing tooth.

Having shown the foregoing pictures of low power, let us now study some photographs which are of a higher magnification. In Fig. 5 is shown an area in the immediate vicinity of the gingivus of the deciduous tooth. Beginning at 1 is shown an area, the fibers which are the direct continuation of the periosteum of the alveolus; at 2, is shown the cementum of the deciduous tooth; at 3, the cementum of the root of the deciduous tooth; at 4, cross section of a blood vessel in the substance of the alveolar dental ligament; directly below at 4, is shown an area in which one notes that the fibers of the periosteum are turned at an angle, and it is at this point that the author no longer terms the tissue the periosteum, but instead—the alveolar dental ligament. Histologically the structure of the tissue is the same as the periosteum.

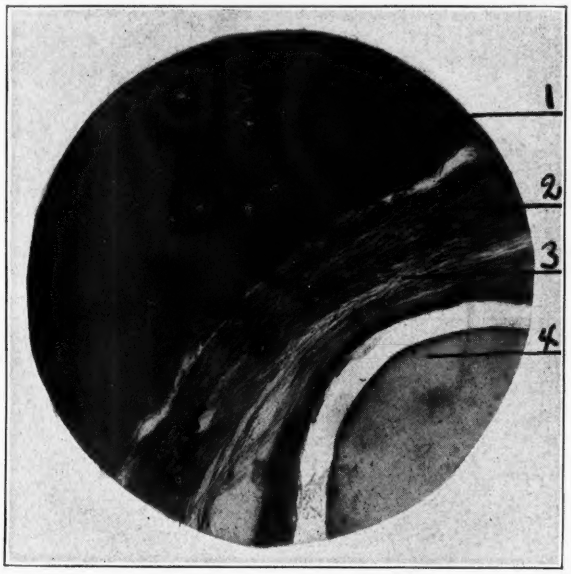


Fig. 7.—Showing an area in which the fusion of the alveolar dental ligament and the fibrous capsule surrounding the alveolar dental ligament is complete.

In the next picture, which is a continuation of the fibers shown in Fig. 5, is shown an area at the end of the root of the deciduous tooth. Beginning at 1, we observe the lacunæ of the cementum of the deciduous tooth; at 2, the cementum; at 3, the dentine; at 4, the alveolus; at 5, the alveolar dental ligament of the deciduous tooth; at 6, an area presenting the fibrous capsule which surrounds the developing tooth; and at 7, is shown the point of union of the alveolar dental ligament of the deciduous tooth and the fibrous capsule which surrounds the developing tooth.

In this next picture we are bearing out a previous statement, and the evidence being a photograph, we must at this time accept the previous statement. In the next picture, which is a continuation of Figs. 5 and 6, is shown a field in which the fibrous capsule and the alveolar dental ligament are one and the same tissue microscopically and anatomically.

Beginning at 1, which is the dentine in the deciduous tooth, and advancing to

2, is shown the alveolar dental ligament of the deciduous tooth. At 3 is shown an area in which the fusion of the tissues is complete while at 4 a slight separation is noted. This separation of the tissues is the result of the pulling apart of

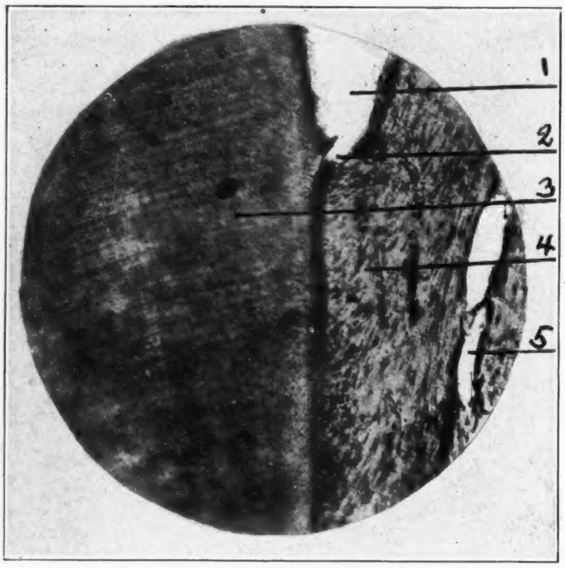


Fig. 8.—Showing the future gingivus of the developing permanent tooth.


Fig. 9.—Showing the fibrous capsule at the future gingival area.

the tissues, and at 5 is shown the space which is occupied by the enamel of the permanent tooth.

In Fig. 7 we have substantial evidence that the fibrous tissue of the capsule which surrounds the developing permanent tooth is of the type known histo-

logically as the periosteum of the alveolus; and further, that the tissue is a continuation of the periosteum.

In the next picture (Fig. 8) is shown a field which presents the future neck of the permanent tooth and also its gingivus. At 1 we note the area occupied by the enamel; 2 is the future gingivus and point of attachment to the periosteum; 3 is the dentine; 4 is the alveolar dental ligament, 5 is the alveolar border of the alveolus.

In the next picture (Fig. 9) is shown a higher magnification of the same field as shown in Fig. 8. At 1 is shown the future gingival attachment of the periosteum; at 2 is shown the cementum, and directly to the left of the heavy shaded cementum, some cemental cells are shown. This row of cells can be traced by careful focusing to the extreme apical area of the developing tooth. At 3 is shown the alveolar border; at 4, the future alveolar dental ligament.

From the foregoing pictures we learn that the alveolar dental ligament of the tooth and the periosteum of the alveolus are histologically the same in type; and that the alveolar dental ligament is a direct continuation of the periosteum into the root socket; and, further, that the fibrous capsule which surrounds the developing permanent tooth is a direct continuation of the alveolar dental ligament of the deciduous tooth, and, therefore, the fibrous capsule is a continuation of the periosteum. We also learn that the function of the alveolar dental ligament is that of a ligament, also that it is a limiting membrane, and that it is not concerned in the development of the cementum or the alveolus directly. But, as previously stated, it limits the growth of the cementum of the root of the tooth and the alveolus that forms the root socket.

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# TREATMENT OF A CASE OF EXTREME MAXILLARY MALFORMATION IN ADULT LIFE

By L. J. Huber, D.D.S., St. Genevieve, Mo.

FIGURE 1 represents the unfortunate condition of a lady who was permitted to reach adult life with an extreme type of maxillary malformation and labioversion of the upper incisors. This condition seriously impaired the normal masticatory function in its initial stage and resulted in a repulsive type of facial deformity, with the central incisors exposed and a marked eversion of the lips.

Properly administered orthodontic treatment in her youth, would have arrested the malformation and corrected the malocclusion and the accompanying facial deformity. In reply to her repeated inquiries, the presumably authoritative, though unscrupulous, advice was, that she would outgrow her deformity in a few years. In this instance the patient had to learn through bitter experience, as many others have, the truth of the statement that, "Malocclusion and its accompanying deformities grow steadily worse; nature and time rarely exercise a corrective influence," as Lischer points out in his admirable book, "Orthodontics."

The patient in her 28th year, painfully conscious of her malocclusion and facial deformity, applied to the writer for treatment. After a consideration of the nature and extent of the abnormality to be corrected, and the condition to be established, it was evident that any effort to bring about the desired result by orthodontic treatment would prove futile. However, the possibility of surgical means as an effective procedure suggested itself.

Following the administration of a local anesthetic, the upper central and lateral incisors were extracted, the overlying soft tissues with the periosteum dissected back about, 10 mm. of the labial and about 8 mm. of the lingual process curetted off, thus presenting a rounded surface. Next the interproximal points of gum tissue were clipped off allowing the tissue to meet in apposition.

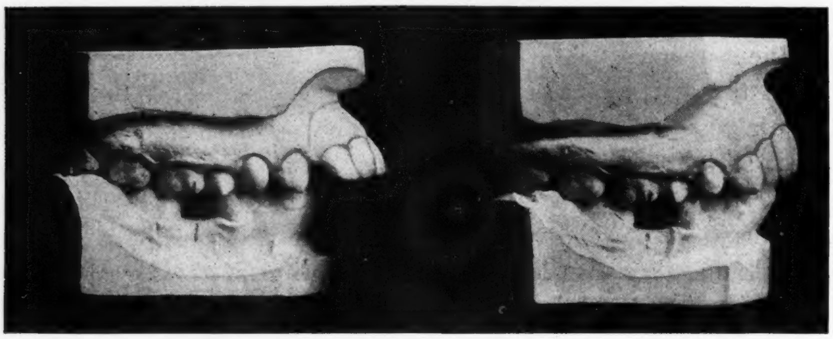


Fig. 1. Fig. 2.

Surgical stitches were employed for the purpose of holding the tissues in position; these were removed after four days.

After a period of three weeks, conditions were such as to permit the insertion of a four tooth individual saddle bridge with inlay attachments to the cuspid teeth. The results obtained can be seen in Figure 2, a marked reduction of the labial arch; not a normal, but a vastly ameliorated occlusion. The patient can now bite off foods; upon closure of the jaws, the lips meet in apposition, and a marked degree of improvement is noticeable in the profile.

One year has elapsed since the above operation was performed, and in that time the patient has twice reported for observation of conditions. The results obtained are permanent and satisfactory in every respect; and in my opinion, this is the proper method of treatment for such conditions in adult life.

# THE USE OF .0225 ALIGNMENT WIRE

By Allen Holman Suggett, B.S., D.D.S., San Francisco, Cal.

THERE is a prevailing idea, that a great deal of force is necessary to move teeth and expand arches. If results are not obtained immediately, it is because there is not enough force. Therefore more force is applied. We have become accustomed to the action of the 16 gauge wire, and it is hard to conceive of tooth movement being produced with anything less rigid.

### THE .030 WIRE.

When the .030 wire was introduced, some three or four years ago, and the claim was made, that with it the teeth could not only be moved but moved bodily, and whole arches could be expanded, many shook their heads in doubt for it seemed absurd. Experience has proved that all this can be done with the .030 wire. Articles in the different journals, however, show that many of the leading orthodontists are using much larger wire, and are very slow in accepting .030 Some are using large wire with pins and tubes to move only one or two teeth at a time—just cutting off an inch of the dog's tail at a time.

### THE .0225 WIRE.

I stated in my paper at the Pittsburg meeting that there was a tendency to use much smaller wire and that I thought we would come to use 0.225.

After a year's trial of the 0.225 wire, I am so pleased with it that I have changed all my .030 wire for the smaller one, because in using the .030 with direct attachments to all, or nearly all of the teeth, it was soon apparent that it was too rigid.

### LARGE AND SMALL WIRES PRESENT DIFFERENT PROBLEMS.

An arch wire that is attached only from molar to molar, presents a very different problem from the wire with direct attachments, stationary anchorage, if you please, to eight or ten teeth. A wire that has four inches between the attachments presents different problems from the one with attachments every half of an inch. For such use, the .030 wire was too rigid, and I began using .0225 wire after seeing Dr. Robinson's clinic. Since then I have used only the .0225, and am very much pleased with it, for it enables me to discard the D band, with all of its objectionable features, including the sectional arch wire.

### SIMPLICITY OF THE .0225 WIRE.

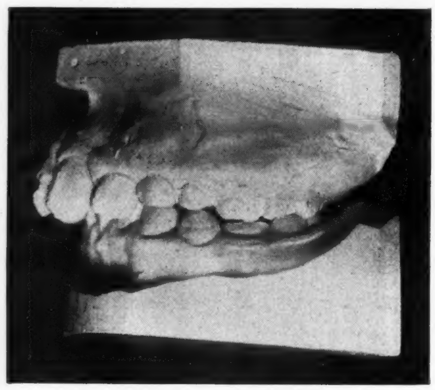
This wire can be used with the Robinson attachments or with the pins and tubes, or with both. In very close bites of the molars, the Robinson attachments are especially indicated. The technic can be demonstrated better by illustrating how to proceed with a given case.

### A CASE FROM PRACTICE.

Case 1, Mr. B. B., age 11. Bands were made for the upper molars of material consisting of platinum 6%, gold coin 94%, soldered with platinum gr.

$\frac{1}{2}$, silver gr. 1, gold coin dwt. 1. The bands are 32 gauge thick and $\frac{3}{16}$ wide. After burnishing the bands to the teeth, gold-platinum tubes, gauge .023, length $\frac{5}{32}$ are soldered vertically, slightly anterior to the middle of the buccal side of the bands, with 16 solder, and a spur of .030 on the anterior lingual side to rest against the baby molar.

Bands of the same material, but of 38 gauge, are made for the baby cus-



Case. 1.

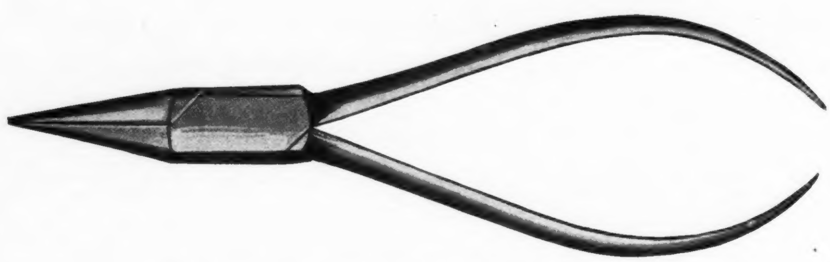


Fig. 1.—Sharp-nosed pliers for bending .0225 wire.

Fig. 2.—After first bend is made in wire.

Fig. 3.—Second step.

pids, with a spur to rest on the lingual of the first baby molar. The tube should be placed slightly to the distal of the middle of the tooth, to take care of the side pressure necessary to carry the baby molar.

Bands of 38 gauge are made for the centrals and laterals with the tubes slightly to the distal of the middle, as these teeth are to be rotated. After the bands have been boiled and the tubes filled with soap or wax, cement them on the teeth with a good quick setting cement.

CONSTRUCTING THE ALIGNMENT WIRE.

The next step is the shaping of the alignment wire and soldering the pins. It is a combination of platinum and gold, .0225 in diameter, and can be gotten from the Blue Island Specialty Co., The S. S. White Co., and other dealers, under the name of pin tube, or orthodontic wire.

Take a piece of wire about six inches long, and with pliers (Fig. 1) bend the end as shown in Fig. 2. Then place this right angle in the left molar tube, and after getting the length of the loop, make a scratch on the wire to indicate where the next pin should be soldered (Fig. 3). Pins $\frac{3}{16}$ inch long, cut from the same .0225 wire, with a small sliver of 16 gold solder melted to one end, should be at hand ready for use. Dip the end of this pin in S. S. White flux, and solder it to the wire as indicated by the scratch. A jig, or any other

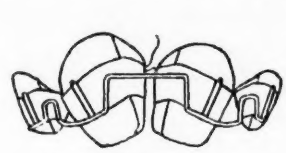


Fig. 4.

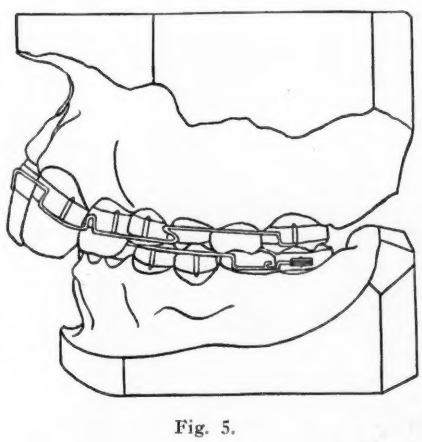


Fig. 5.

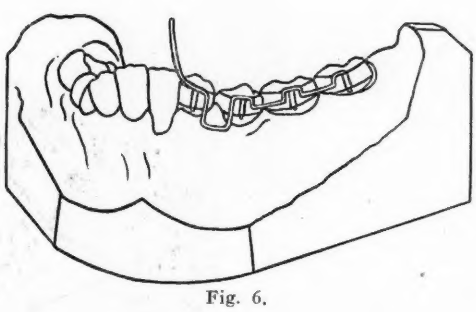


Fig. 6.

mechanical apparatus, is absolutely unnecessary, unless the operator is pretty shaky. The jig was thought to be necessary when using the stiff .030 wire, which was too rigid to bend and adjust if the pin was not absolutely in the correct position. In making the loop just distal to the cuspid, shape it so that it will act as a hook for the Baker anchorage. Either do this, or solder a small piece of wire for this purpose. Make your next loop and get your measurement for the next pin, as before, but provide for the rotation of the centrals and laterals as shown in Figs. 4 and 5, where the loop rests on the mesial corner of these teeth.

PUTTING THE ALIGNMENT WIRE IN PLACE.

After boiling the appliance and slightly bending the pins so they will bind in the tubes, and shaping it to as near an ideal curve as practicable, it is ready to slip in place. There is no need of adjusting it again for several months, and possibly not at all, for there are the hooks for Baker anchorage, the spring

for the necessary expansion, and the upward spring necessary to carry the incisors upward and reduce the excessive overbite, as shown in Fig. 5.

### DIFFERENT PROBLEM IN THE LOWER ARCH.

In attaching the lower, the close bite of the molars presents another problem. The pins and tubes are indicated, but it is an ideal place for the Robinson attachment, which requires less vertical room, Case 1, and Fig. 5.

The molar bands are fitted just as the upper were, with lingual spurs to carry out the baby molars. All the other teeth on the lower arch are banded and tubed, and the wire and tubes adjusted just the same as on the upper, except for the Robinson attachment on the molars, and that the wire is not sprung in to attach to the right lateral, but a rubber is looped over it until it is a

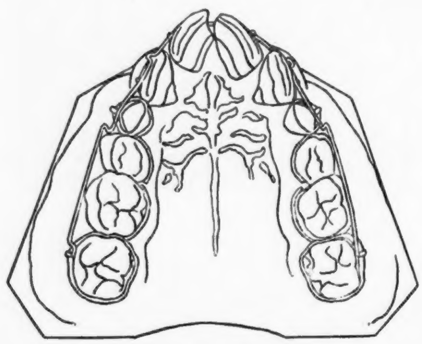


Fig. 7.

Fig. 8.

little nearer the line, when the pin can be slipped into the tube and the root movement is made in unison with the others (Fig. 6).

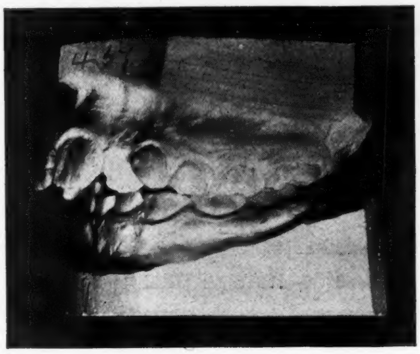
A hook for Baker anchorage is soldered on the wire just anterior to the molar attachment, and this arch wire is ready to slip into place (Fig. 5). Figs. 7 and 8 show the occlusal view.

### ADJUSTING.

The loops can be spread without removing the wire, but after two or three such adjustments, the wire should be removed for fear it is out of alignment, corrected and put back. When the case is near completion, some of the bands may be removed to allow any over spacing to close up, and the rest of the appliance left in place as a maintainer.

A CASE OF NEUTROCLUSION.

Case 2, Miss V. B., age 8, is quite a unique case of neutroclusion, with very narrow arches (Fig. 9) and the spaces for the lower cuspids entirely closed. All the teeth were banded for bodily movement. The loops between the laterals and the baby molars should have enough wire to provide room for the cuspids when the wire is partly or nearly straight.



Case 2.

Fig. 9.

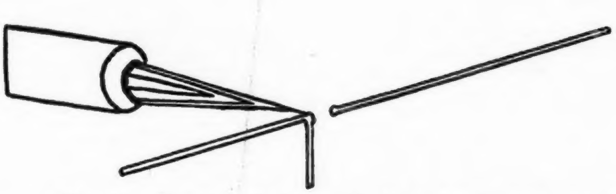


Fig. 10.—Shows method of soldering a break near one of the pins. Let the pin hang downward and the solder will hold it in place while the union is being made with the other piece.

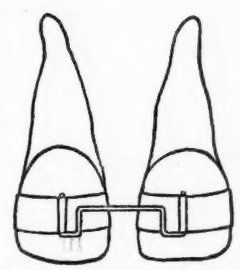


Fig. 11.—Shows appliance for closing a space, also to rotate one or both teeth.

The upper alignment wire was adjusted with enough spring to carry the case nearly to completion. The lower requires a little enlarging of the loop every month, but the pressure should not be increased fast enough to cause tipping. Go slowly enough to keep the masticating surfaces in good contact, when the jaws are closed, but not to move the crowns faster than the roots.

NOT VITAL THAT TUBES SHOULD BE PARALLEL.

All tubes should be as near parallel and on the same horizontal plane as pos-

sible, but this is not vital. Neither do the pins have to be at exactly the proper distance, because the loops will allow of considerable change. It is also quite apparent that if the tubes were exactly parallel and on the same horizontal plane, on teeth that were inclined toward each other, they would not continue in that relation long after correction was begun.

### SOME OF THE ADVANTAGES OF THE .0225 WIRE.

It is, therefore, quite apparent that this small wire presents a much simpler problem to master, in making the appliance, in adjusting it, and in repairing it if broken. It is so pliable that one can spring it to a tooth that is far out of line, and slowly and comfortably move it where desired. The large wire is too rigid to do this without many adjustments. The small wire will allow of much more play and freedom, and a more normal bone development. The D band can be eliminated, with the buccal tubes and the screw, the three piece arch wire and the special pins at 40 cents each, and the jig. Thus we have a smaller, neater appliance that is easier made, and which keeps all the teeth moving at the same time.

# *DEPARTMENT OF*
# *DENTAL AND ORAL RADIOGRAPHY*

JAMES DAVID MCCOY, D.D.S., EDITOR
LOS ANGELES, CALIF.

## X-RAY MACHINES

BY JAMES D. MCCOY, D.D.S., LOS ANGELES.

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IT is no longer necessary to advocate the use of the x-ray in any of the various branches of dentistry, as the profession has at last awakened to the fact that this agent is not to be regarded otherwise than as a necessity. As a result of this conclusion, most up-to-date practitioners are contemplating the installation of x-ray apparatus as a regular part of their office equipment. While many are actually taking steps in this direction, the majority are putting off the actual purchase of equipment, as they are more or less at sea concerning the apparatus which is best adapted to their needs. This is due for the most part to the fact that the dentist of today is offered such a wide choice in the way of equipment, and also to the fact that some representatives of manufacturers of x-ray apparatus are so extravagant in their claims, that the prospective purchaser hardly knows what to believe and what not to believe.

Of course, the first requisite of the dental x-ray laboratory which the dentist must consider is the so-called x-ray machine. Inasmuch as this requisite is such an important factor, the author has deemed it expedient to discuss the subject with the hope that by properly classifying them, he may make it possible for his readers to more intelligently cope with the problem of the selection of this particular piece of apparatus.

The object of the so-called x-ray machine is to produce a high potential electric current which can be passed through the x-ray tube and thereby produce the x-rays. The ordinary lighting current of 110 volts is inadequate for this purpose, as it is of far too low potential (voltage) to pass through the tube, as the vacuum offers a resistance which to the ordinary current amounts to an absolute nonconductor. We are obliged, therefore, to make use of some electrical means whereby the ordinary current may be "stepped up" to a high voltage, a voltage we will say of from 75,000 to 150,000 volts.

To do this we must make use of one of the electrical machine which can generate such a current by utilizing the principle of electro magnetic induction.

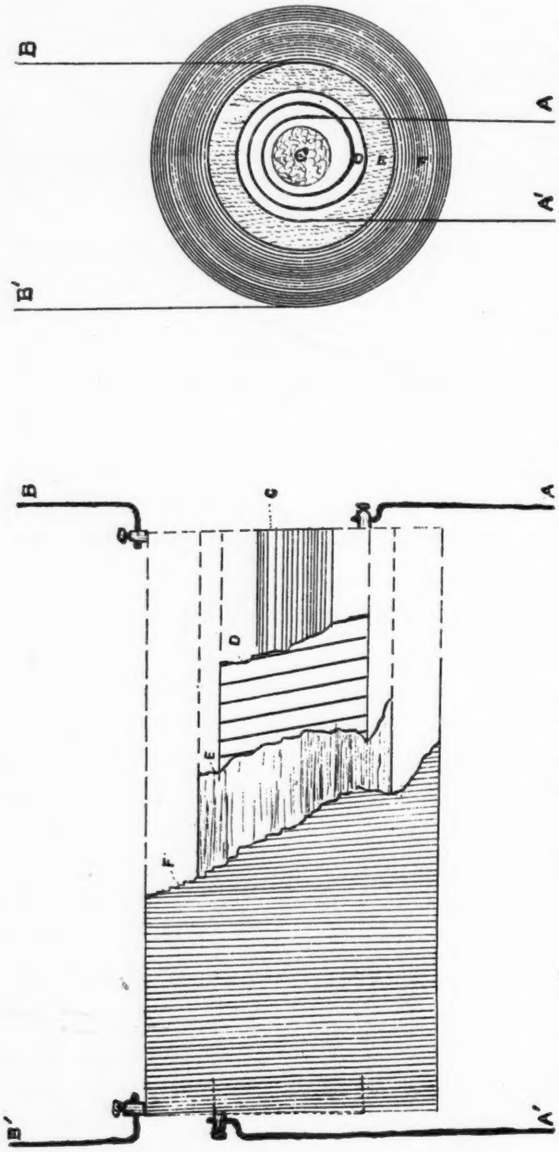


Fig. 1.—Diagrammatic illustration of the essential parts of an induction coil. *A'* and *A* are the terminals of the "primary coil." *D* represents the windings of the "primary" about the magnetic core *C*. The insulating medium between the "primary" and "secondary" is shown at *E*. The windings of the "secondary" coil are designated by *F*, and the "secondary" terminals by *B* and *B'*.

Such machines are classified under three headings:

1. The Rhumkorff, or induction coil.
2. The Tesla, or high frequency coil.
3. The Interrupterless transformer.

### THE RHUMKORFF, OR INDUCTION COIL.

The Rhumkorff, or induction coil, is perhaps the most common type of x-ray machine in use today. Its principles of construction may be briefly described by stating that it consists of three essential parts, of which two are coils of wire, one contained within the other, although they have not electrical connection, and the third, an instrument known as an interrupter.

The inner coil, or primary as it is called, consists of a few turns of very coarse wire wrapped about a core of soft iron, which is known as the magnetic core. The outer coil or secondary, is made up of a great many turns of fine

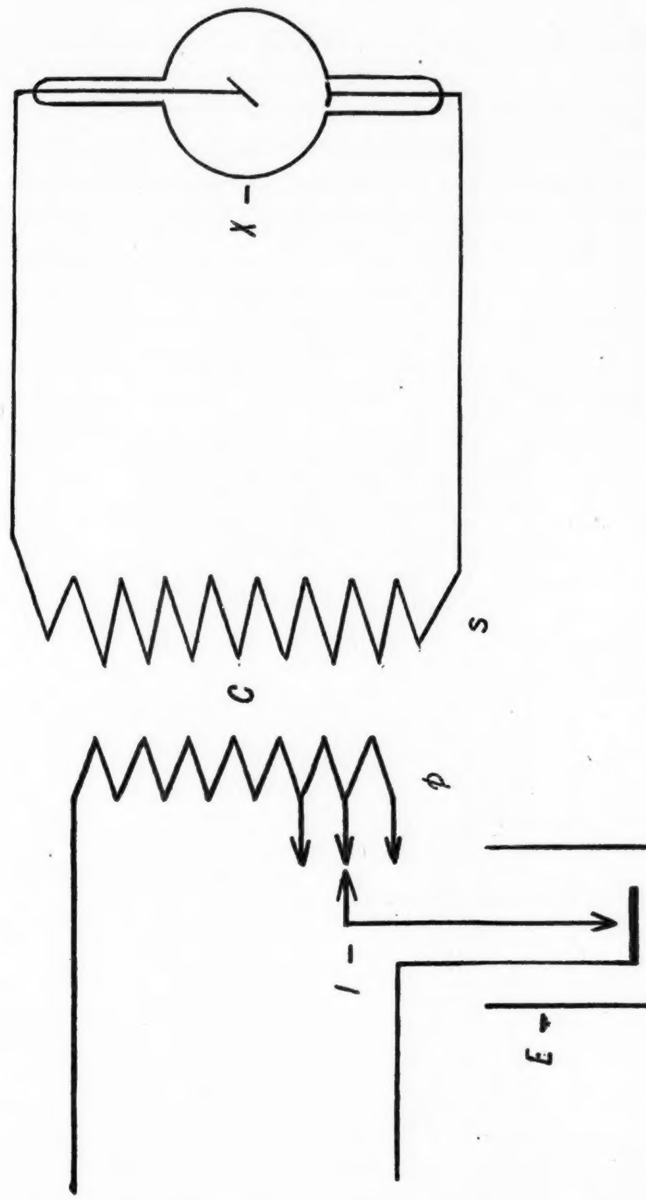

Fig. 2.—Diagram of the induction coil. *C*, induction coil; *P*, "the primary;" *S*, "the secondary;" *E*, electrolytic interrupter in circuit with the primary coil; *I*, rheostat and inductance control; X, x-ray tube connected to the terminals of the secondary coil.

insulated wire. The principles of construction of the induction are shown in Fig. 1.

The other requisite of the induction coil as mentioned, namely, the interrupter, is attached in circuit with the primary coil, and serves the purpose of rapidly interrupting the primary current which is necessary to produce and maintain the phenomenon of electro-magnetic induction. (See Fig. 2.)

The current which is taken from the x-ray machine and passed through the x-ray tube, comes from the terminals of the secondary coil, and is an induced current, produced by the magnetic field of the primary coil. As everyone is more or less familiar with the principles of electro-magnetic induction the writer will not discuss the subject to any extent. Suffice it to say here that the voltage of the transformed or induced current coming from the terminals of the secondary coil depends upon the ratio existing between the num-

ber of turns of wire in the primary and the number of turns of wire in the secondary.

If an induction coil is constructed with the same number of turns in the secondary as are present in the primary, the current induced in the secondary will be exactly equal to the current passed through the primary. The voltage will not be increased. On the other hand, if the secondary contains twice as many turns as the primary, the induced current will be double the voltage of the primary as each turn of the secondary induces a current in the turn directly adjacent to it, which must be added to the current induced in the first layer by the action of the primary current. Therefore, as we increase the number of turns in the secondary, we increase the E. M. F. or voltage.

It has been estimated that in a 12 inch induction coil, the secondary is

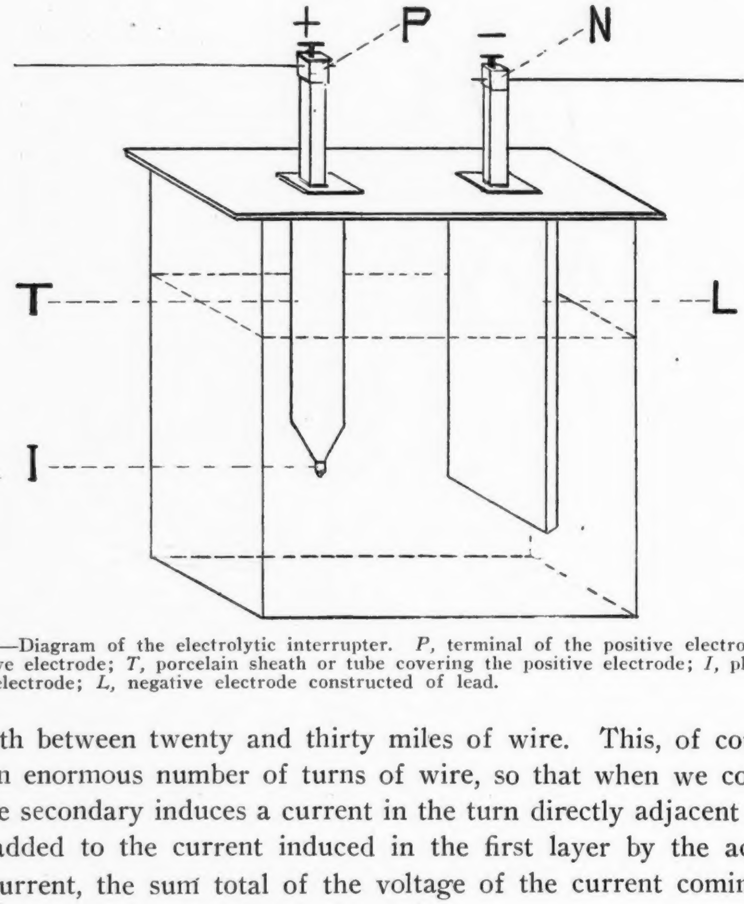


Fig. 3.—Diagram of the electrolytic interrupter. *P*, terminal of the positive electrode; *N*, terminal of the negative electrode; *T*, porcelain sheath or tube covering the positive electrode; *I*, platinum point of the positive electrode; *L*, negative electrode constructed of lead.

wound with between twenty and thirty miles of wire. This, of course, makes possible an enormous number of turns of wire, so that when we consider each turn of the secondary induces a current in the turn directly adjacent to it, which must be added to the current induced in the first layer by the action of the primary current, the sum total of the voltage of the current coming from the secondary amounts to something tremendous.

Another phenomenon not to be lost sight of, is that as the voltage or E. M. F. is increased, in the before described manner, the amperage or current strength is decreased in equal ratio. It will be seen, therefore, that the original current running to the primary is not changed in actual value but is simply transformed to a state or condition where it will do the special work required of it.

As stated previously, the phenomenon of electro-magnetic induction is

maintained by an instrument which rapidly interrupts, or in other words "makes" or "breaks" the primary current.

Two classes of these instruments are made, both of which utilize some automatic principle, and are known as "mechanical" and "electrolytic."

*Mechanical interrupters,* a simple illustration of which is the ordinary vibrator used on small coils, electric bells, etc., will rapidly make or break the primary current and thereby induce a fairly constant current in the secondary;

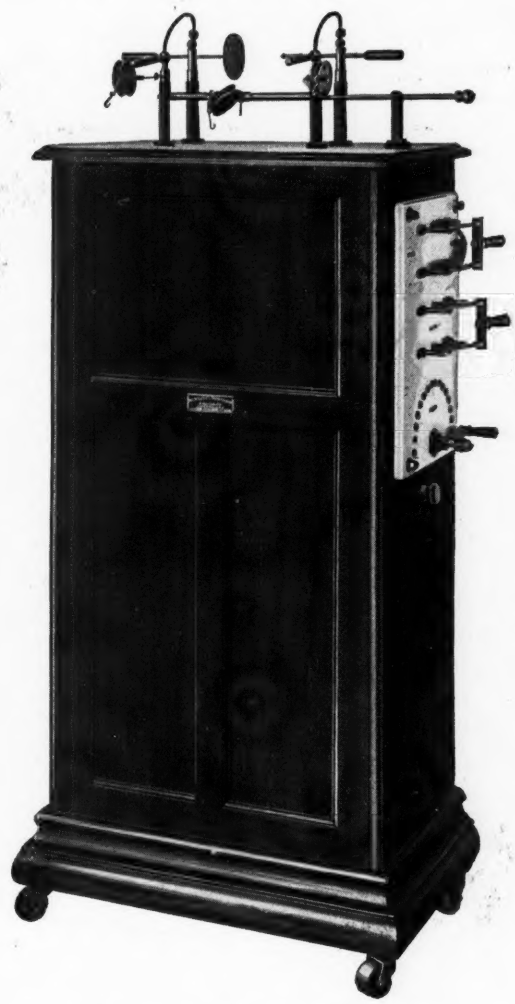

Fig. 4.—Induction coil, cabinet type.

but this form of interrupter has not been found to be as satisfactory for x-ray work as the electrolytic type.

Of the various forms of *electrolytic interrupters,* the Wennelt type is the most universally used. It consists of a large battery jar which is nearly filled with a solution composed of sulphuric acid, one part, and water, six parts. Into this solution are introduced two electrodes. The negative electrode is constructed of lead and has a large surface exposed, while the positive electrode is contained within a porcelain or hard rubber tube extending down into the solution with only the tip or end of the electrode exposed. The tip of

this electrode is usually made of platinum. Such an instrument is diagrammatically shown in Fig. 3.

The electrolytic interrupter is connected in the primary circuit and operates briefly as follows: As the current passes from the platinum point (the

Fig. 5.—Induction coil, cabinet type.

positive electrode) through the solution to the negative electrode, by virtue of its chemical action upon the solution, bubbles of gas are formed around the exposed platinum point. These bubbles act as a source of insulation and the current ceases to flow—*it is interrupted.* At the instant it is interrupted, the bubbles are dispersed, the solution again comes in contact with the electrode,

and the current is reestablished only to be broken again, and so on; these changes taking place with tremendous frequency. With such an instrument the primary current may be interrupted from 60 to 30,000 times per minute. These interrupters are sometimes constructed with several platinum points which makes possible a greater amperage in the current without decreasing the rate of interruptions. For dental radiography, however, a single point inter-

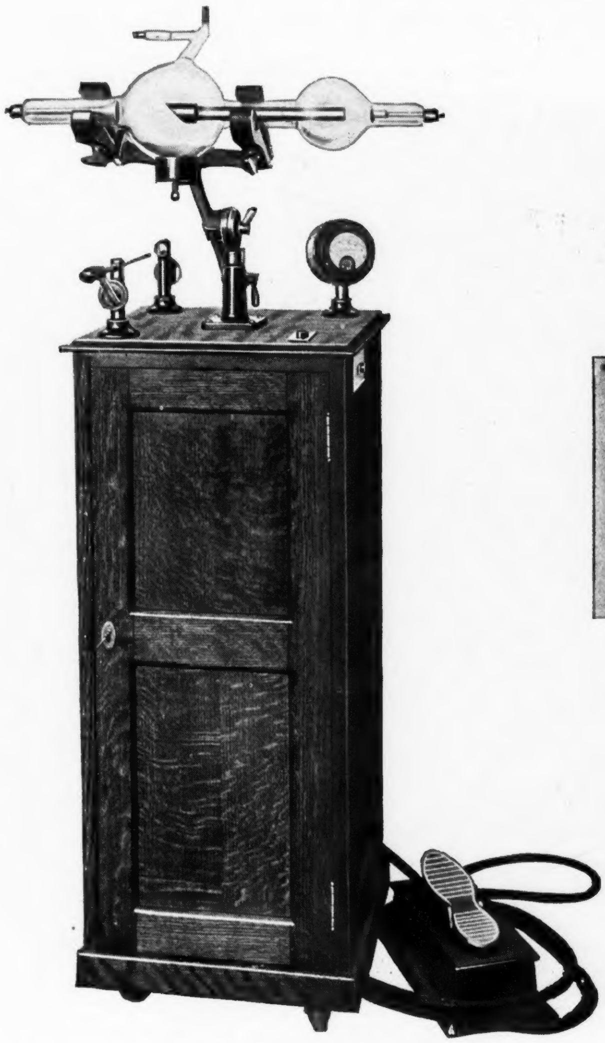

Fig. 6.—Induction coil with tube stand attached.

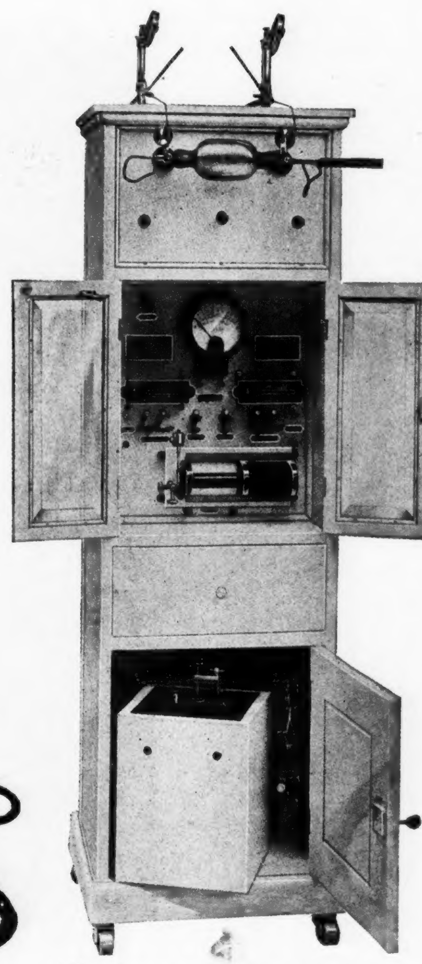

Fig. 7.—Induction coil of cabinet type.

rupter will usually suffice, and at most, not more than a two point interrupter need be used.

The interrupter, then, serves the purpose of creating the magnetic impulses which keep a constant current flowing from the secondary. We should bear in mind, however, that the currents produced by the "make" and "break" are not of equal strength, the current produced at the "break" having much the highest value. Due to the fact that this current is the strongest, and that the magnetic impulses come from the same direction (as the induction coil is used on the direct current) it prevails over the weaker. Therefore the induced or

secondary current which we use to energize the x-ray tube is the current which is created at the instant of the break.

The other wave, or that created by the "make," is current in the wrong direction, and is called "inverse current." In some induction coils this inverse current is the source of much trouble and where it is present to any appreciable extent, will result in blurred radiographs. It can be controlled, however, by the use of "valve tubes," or a "spark gap," arranged in series with the x-ray tube, the valve tube or spark gap serving the function of cutting out the weaker or

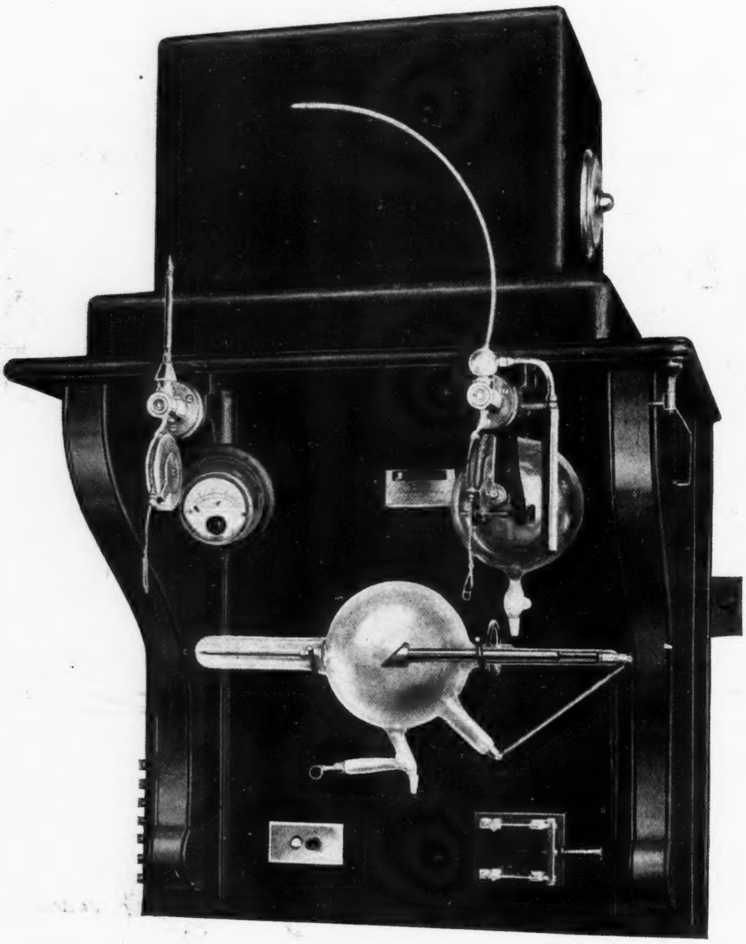

Fig. 8.—Induction coil constructed so that it may be attached to the wall.

inverse current, without interfering to any appreciable extent with the stronger current which is delivered to the terminals of the x-ray tube.

The induction coil is used on the direct current of 110 or 220 volts. Where only the alternating current is available, some means must be used to change the current from alternating to direct before it enters the primary circuit of the coil.

This change in the current can be accomplished by the use of a "rotary converter" of which several makes are available, or by a "chemical rectifier." These rectifiers generally consist of two electrodes immersed in a solution of

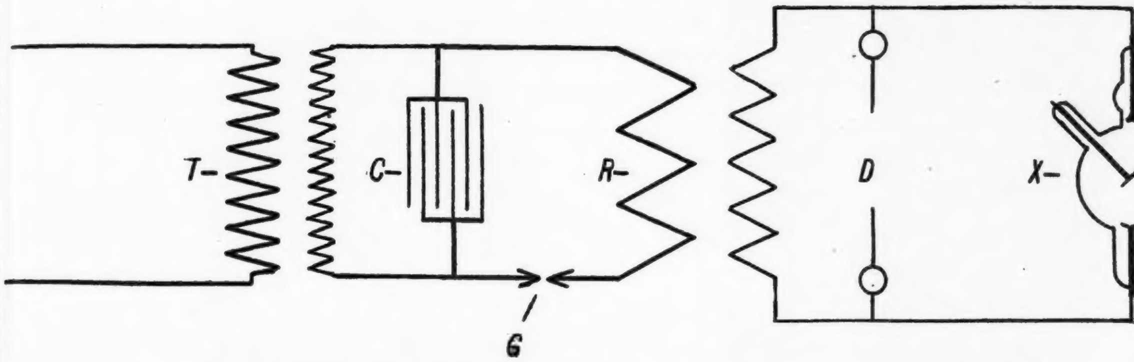


Fig. 9.—Diagram of the high frequency coil. *T,* alternating current transformer; *C,* condenser; *G,* spark gap; *R,* oscillation transformer; *D,* high tension discharge gap; *X,* high frequency x-ray tube.

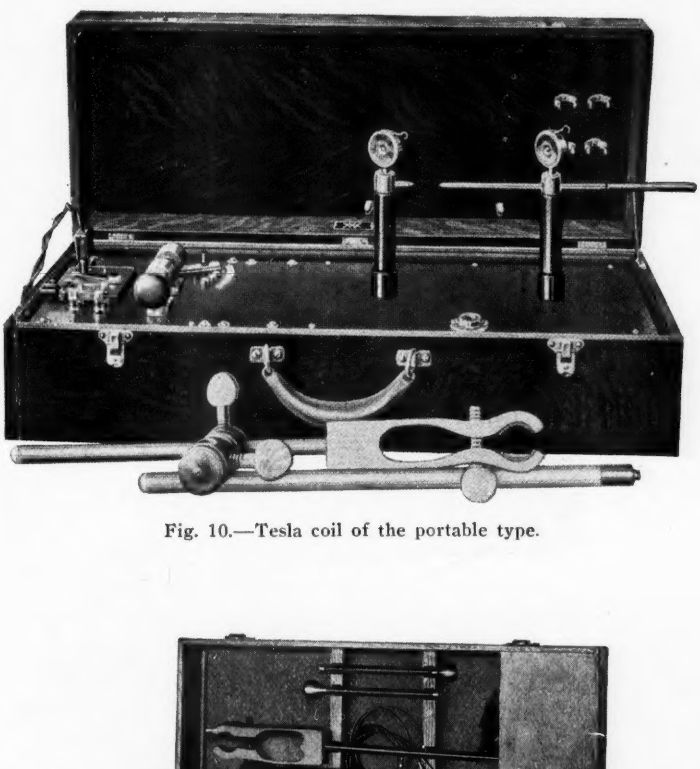

Fig. 10.—Tesla coil of the portable type.

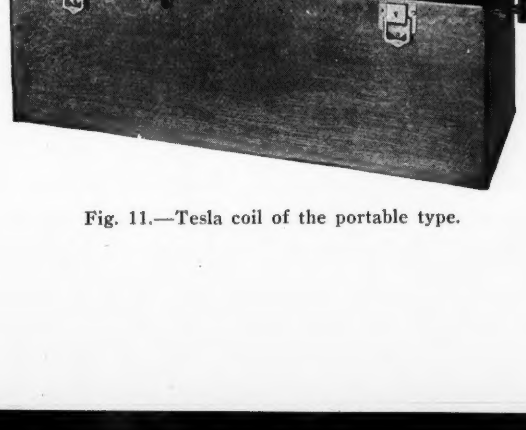

Fig. 11.—Tesla coil of the portable type.

the phosphate salts of potassium, sodium, or ammonium, one electrode being made of aluminum, and the other of lead, or carbon. When working properly, the current will flow to the aluminum through the solution, but not away from it, thus cutting out one wave of the alternating current, or it is possible, by properly connecting up three or four jars containing the electrodes, to utilize both waves of the current.

Induction coils are usually rated as to power by the maximum width of the secondary spark gap. That is, the amount of distance the spark will jump between the secondary terminals. For example, a 12-inch induction coil is capable of producing a spark which will jump twelve inches of atmosphere. While these coils are made in various sizes, capable of producing a spark from six

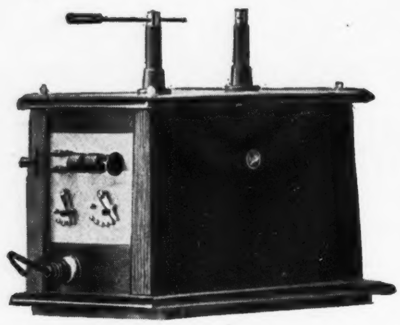

Fig. 12.—Tesla coil, adapted for attachment to the office wall.

Fig. 13.—Tesla coil, adapted for attachment to the office wall.

inches to forty inches in length, there is no particular advantage in using more than a 12-inch coil for dental radiography. Figs. 4, 5, 6, 7, and 8 show 12-inch induction coils constructed especially for the dental x-ray laboratory.

### TESLA OR HIGH FREQUENCY COIL.

The Tesla, or high frequency, coil differs considerably in construction from the induction coil, although many of its principles are the same. In a way it is a double induction coil with the secondary of one coil acting as the primary of the other coil. An alternating current is utilized in the primary of the first coil and by means of the secondary of this same coil, is stepped up to a high voltage. This stepped up current is then carried to a condenser. As the current leaves the condenser it is oscillating at a great rate of frequency and passes into the primary of the Tesla or second coil where it induces a current in the

Fig. 14.—Tesla coil, cabinet type.

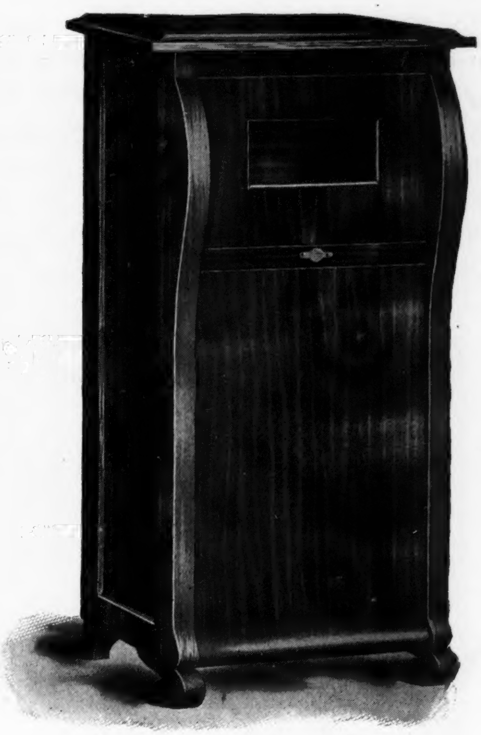

Fig. 15.—Tesla coil. Completely inclosed when not in use.

Fig. 16.—Tesla coil.

Fig. 17.—Tesla coil. Completely inclosed when not in use.

secondary of this coil. From the terminals of the last secondary, it is carried to the x-ray tube. The principles involved in this type of apparatus are shown in Fig. 9.

Like the current of the induction coil, the current from the Tesla coil is

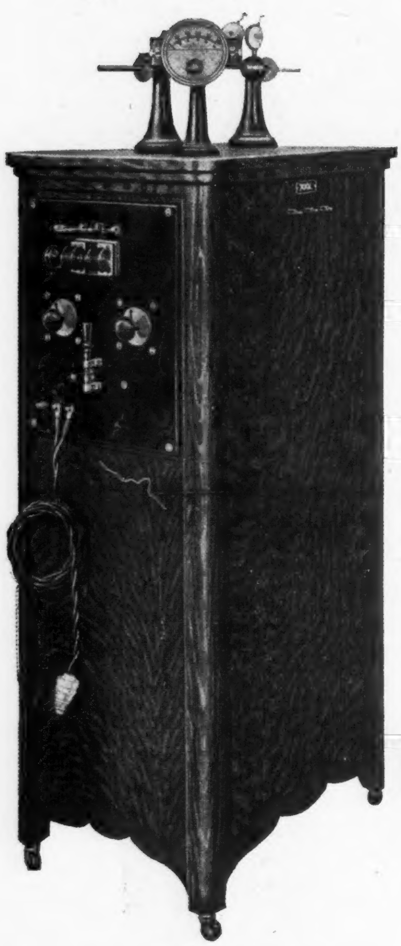

Fig. 18.—Tesla coil, cabinet type.

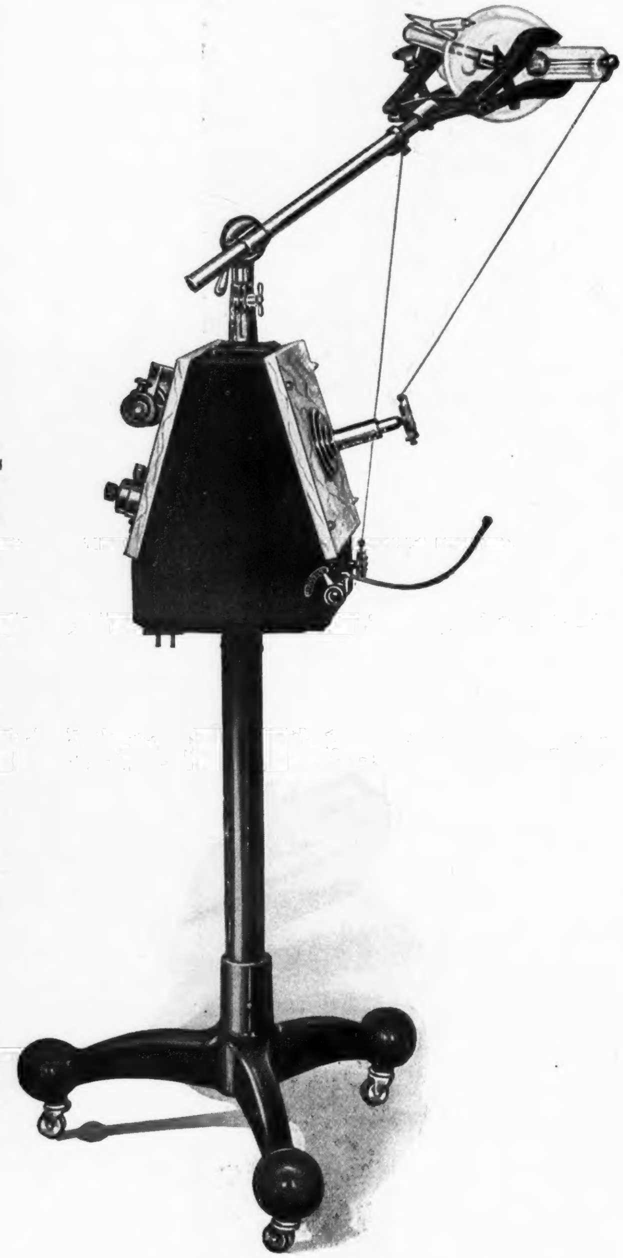

Fig. 19.—Tesla coil, mounted upon movable standard.

high in voltage and low in amperage, but, unlike the current from the induction coil, it is not unidirectional, but is alternating in character. For this reason, it is considered by some as being less desirable for radiographic purposes. However, this apparently objectionable feature is overcome by using an x-ray tube

constructed in such a way as to cut out one wave of the current and thereby produce practically the same result as where an unidirectional current is used.

These coils have the advantage of being less cumbersome, require less space, and are less expensive than the other forms of apparatus, but they cannot be depended upon to do the character of work which the powerful "induction coil" or "interrupterless transformer" will do. Notwithstanding this fact, this type of apparatus undoubtedly has a place in the x-ray laboratory of the dentist, and if constructed along proper lines, can render splendid service. Figs.

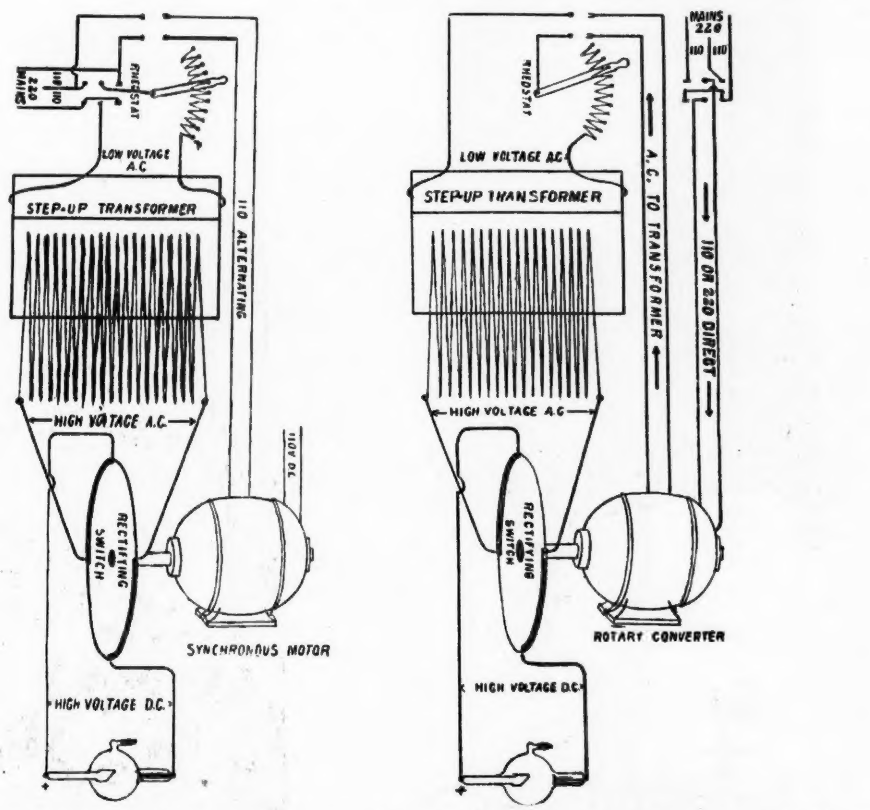


Fig. 20.—The working principles of the interrupterless transformer are here shown. The synchronous motor used to operate the rectifying switch of the alternating current machine may also be used as a rotary converter where the direct current is desired for other purposes in the laboratory.

10 and 11 show Tesla coils of the portable type. Figs. 12, 13, 14, 15, 16, 17, 18 and 19 show Tesla coils which are larger and much more powerful than the portable type.

## INTERRUPTERLESS TRANSFORMERS.

The interrupterless transformer is the newest and by all means the most powerful x-ray machine made. Aside from controlling and measuring apparatus, it consists of three principal parts, a rotary converter, if direct current is the source of supply, or a synchronous motor if the alternating current is the source of supply, a step-up transformer, and a rectifying switch.

Two types of these machines are made: viz., a direct current machine and an alternating current machine, the underlying principles of which are shown in Fig. 20.

Fig. 21.—Interrupterless transformer.

Fig. 22.—Interrupterless transformer.

Fig. 23.—Interrupterless transformer.

When used on the direct current, the rotary converter is set in motion and generates an alternating current which is sent through the primary of the step-up transformer. This induces a current in the secondary of the proper voltage, but alternating in character. The rectifying switch then changes this cur-

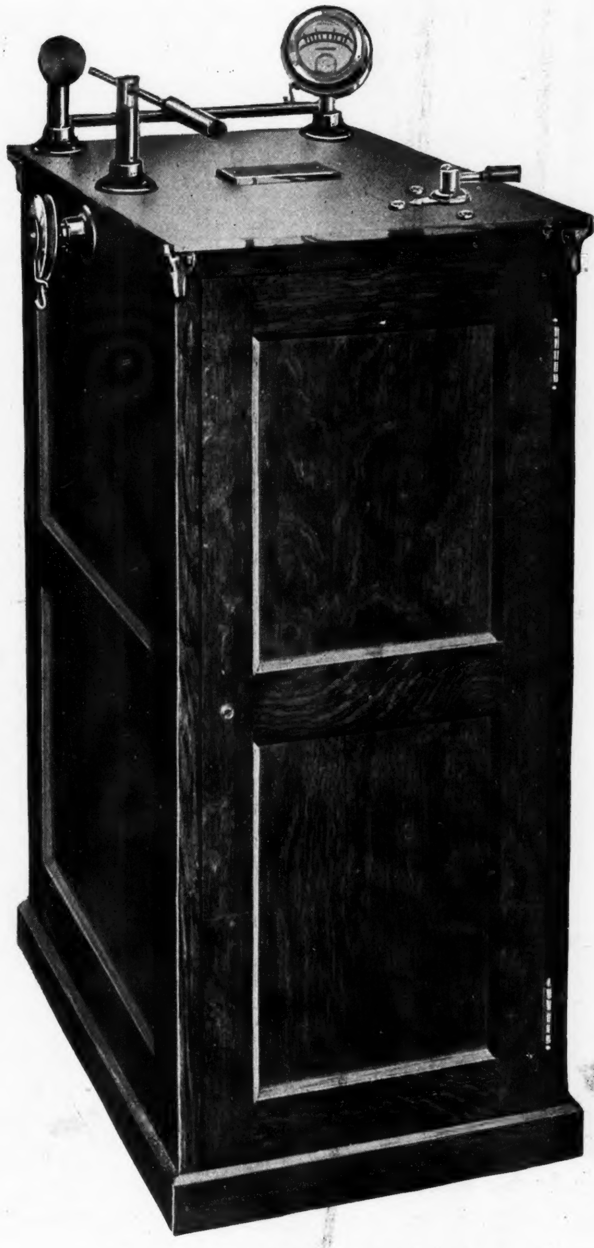

Fig. 24.—Interrupterless transformer.

rent from an alternating to a direct current and as such it is delivered to the terminals of the tube.

The alternating current machine differs only from the direct current machine in that the alternating current is run directly into the primary of the step-up transformer. This induces a current in the secondary of the proper

voltage but alternating in character. The rectifying switch then changes this high voltage alternating current to a direct current, and as such it is carried to the terminals of the tube.

The interrupterless transformer is, as stated before, the most powerful and efficient type of apparatus available for x-ray work. It is likewise the most expensive,—perhaps too expensive to be considered for the x-ray laboratory of the average practitioner of dentistry, in view of the fact that with the induction coil and other less expensive apparatus such excellent results can be

Fig. 25.—Interrupterless transformer.

obtained. Figs. 21, 22, 23, 24, 25, 26 and 27 show interrupterless transformers constructed especially for the dental x-ray laboratory.

The preceding remark, however, should not be construed as an argument against the interrupterless transformer. To the prospective purchaser who desires the very best, regardless of expense, or who expects to do a great deal of radiography, the initial expense should not be the prime consideration, as oftentimes the most expensive things in the long run prove a matter of economy.

In conclusion, I would emphasize the fact that the character of the radiography which any physician or dentist is able to do, does not depend entirely upon the excellence of his laboratory equipment. Instances could easily be

Figs. 26 and 27.—Type of interrupterless transformer.

cited where the best of equipment fails to produce the highest type of results, and vice versa, where unpretentious equipment in some hands has proved more than satisfactory. After all, the comparative degree of efficiency of the various types of x-ray machines must depend largely upon the judgment and skill of those who operate them.

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# *EDITORIALS*

## Is Radiography a Trade or a Profession?

ALTHOUGH radiography was discovered over twenty years ago and has been used in dentistry for several years, it did not gain popularity as a diagnostic agent until the relation between alveolar abscesses and systemic disorders were so widely heralded. Not until the relations between infected teeth and constitutional diseases were proved did the dental profession take advantage of the aid which the radiograph offered to them.

With the adoption of the radiograph by the dental profession as a diagnostic agent, we find many things have occurred which are not exactly as they should be. With the medical profession claiming that devitalized teeth are sources of systemic infection, we find that a number of dentists have accepted that verdict without a question of a doubt and have based their diagnosis entirely upon the radiograph. This diagnosis is often based on the reading of the radiograph by one not properly versed in the interpretation of radiographs. Very often the diagnosis is made without any clinical knowledge of the case.

A radiograph is valuable only as it becomes an aid in conjunction with other means of diagnosis. We have known of teeth being diagnosed by the radiograph as "dead teeth" when every other known means of diagnosis showed them to be "alive." This was not the fault of the radiograph, but was the fault of someone trying to read into the radiograph what they could not see, and the disregard for other clinical symptoms. As a result of this, dental radiography is in a rather peculiar position. Some members of the dental profession have turned against it believing that it has no diagnostic value; others have acknowledged their inability to read a film; while still others are confident that they can properly read any film after having seen one or two radiographs. This is an unfortunate circumstance, but, no doubt, the men who say they cannot interpret a film know more about radiography than those who can read and diagnose any case from any kind of a picture. Those who acknowledge their inability to diagnose every condition from the radiograph are the least dangerous to the public—they realize that radiography is a profession and a specialty of dentistry and can only be properly learned by a long course of professional training, and that radiography is not a "photographic side line" that can be of value to a profession if practiced as such.

The impression seems to have got abroad that the only requisites necessary to become a dental radiographer are sufficient capital to purchase an outfit and the courage to fool with something one knows little about, or the dangers thereof, and the disposition to enter a profession of which one knows little. Unfortunately, there is no law governing the practice of dental radiography in most states. In a few states it might be possible to so construe the law to govern that branch of dentistry, but it would also be possible in most states to construe the law to permit the practice of dental radiography by men who possess no dental or medical training. We find this has actually happened in some states. As a result of the acceptance of the value of the radiograph by the dental profession, many laymen have been attracted by the commercial possibilities of radiography, with the result that men who have no knowledge of dentistry whatsoever have established offices for the taking of dental radiographs. Commercial photographers, electricians, and window trimmers have developed overnight into dental radiographers, some of them not even knowing how many teeth there are in the oral cavity, besides the many other things a dental radiographer should know. Men totally unqualified as dentists or physicians have opened offices in different sections of the country and are making thousands of radiographs daily, a great many of which are beautiful pictures from a photographic standpoint, but most of which are of little value to the patient as an aid in diagnosis, for the radiographer does not know anything about the clinical history of the case and the dentist for whom the radiograph was made has not had enough experience to properly read the film. The dentist does not know the conditions under which the radiograph was taken, the position of the tube, the time of exposure or the technic of developing the plate.

We have mentioned the fact that many men are becoming dental radiographers without any dental or medical training. This is unfortunate; but it is more unfortunate that the dentists should so little respect their profession that

they would be willing to turn their patients to a man to assist them in diagnosing their case, who is not a professional man. If a physician desires to have assistance in the diagnosis of a case, he calls in a man who is a physician, or has had some training along medical lines. If a dentist desires aid in diagnosing a condition, he should respect his profession enough to enlist the aid of a professional man. Still we find dentists who are daily consulting with men who have no dental knowledge and seeking their advice in the diagnosis and treatment of pathological conditions. It takes several years of study to become a dentist, one must possess certain requirements to satisfy the law, but, to become a dental radiographer, one needs only to advertise to the dental profession that he will take radiographs for so much "per," and a large number of the profession are willing to receive him with open arms and consult with a man who knows nothing of anatomy, or pathology, and who has become a dental radiographer because he believes the commercial possibilities are greater than being an electrician, photographer, or window trimmer. These men who have entered dental radiography have no knowledge of professional ethics and use all sorts of means to advertise themselves before the public. Recently, we saw a number of lantern slides, shown by a professional man, that had been made by a commercial (we will not call him a dental radiographer, for we have too much respect for the profession) radiographer, who had placed his name in the slide in such a position that it was the most prominent part of the picture. He recognized the value of advertising, but has chosen a means that we cannot sanction—all because his education was neglected along the proper lines. As the conditions are at present, the dental profession has lowered itself by being willing to allow a class of men, who have no professional knowledge whatever, to diagnose their cases.

Again, dental radiography is only in its infancy and must be advanced along scientific lines to be of any professional value. Men who are only interested in radiography for what they can get out of it will not advance it scientifically.

Also, a patient consults a dentist because the patient knows the dentist must have certain qualifications. The patient wants the services of one educated in the dental profession. Still, the dentist will often betray the confidence of the patient by referring him to a commercial radiographer who knows nothing about pathology, and who has no professional education. It is not fair to the patient. Also, commercial radiographers, knowing nothing about pathology and infectious diseases, are not able to protect the patient as they should. We have even known commercial radiographers to work a half day and not even wash their hands. In taking films intraorally, it is always necessary to at least approach the mouth even if you do not place your fingers in the mouth. If they allow the patients to place the films themselves, occasionally the result will be satisfactory. The possibility of infecting one patient from another by men who have no knowledge of sanitary and antiseptic methods becomes apparent and is no idle dream.

We have already mentioned the fact that many faulty diagnoses have been made by commercial radiographers, and if this continues, the public will lose

faith in radiography, as some are doing already, and dentistry will have to suffer therefrom. The dental profession should be more careful in referring patients to men who have no professional training, than they have been in the past.

Some have suggested that there should be laws made to regulate the practice of radiography. This is not necessary because patients are referred to radiographers and the commercial radiographer will exist only when the dental profession supports him. If dentists are unwilling to consult with men who are inferior to them in professional training, the commercial radiographer will be forced back into the trade from which he came and dentistry will have eliminated one objectionable factor that promises to become as dangerous as the dental parlors.

Dental radiography is a profession and not a trade and should be practiced by professional men.

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## The Appliance Joker

IN the evolution of medical science the day is not so far remote when it was religiously believed that the skin of a black cat, which was killed during the dark of the moon, applied to the human anatomy would quickly remedy almost any complaint which human beings might be heir to. Fortunately, however, time, experience and education have proved the fallacy of all superstition in medicine.

If we are to judge from the character of advertising which proposes to point out the merits of some of our so-called modern orthodontic appliances, we are not as yet beyond the black cat stage in the development of orthodontia as a science. The dental profession is being bombarded with literature and illustrations of orthodontic appliances of the "cure while you wait, work while you sleep" variety which smacks of the patent medicine tactics of yore. It is unique, even from a commercial standpoint, indeed that after men have spent their lives developing basic principles of a science which have been universally accepted by the best informed minds of the world on subjects orthodontic, that advertising should appear pointing out principles directly antagonistic to the generally accepted scientific basic principles of a science.

Manufacturers of orthodontic appliances must keep pace with the advancement of the profession if they expect to retain the respect of the profession for their goods. To advertise principles of treatment and methods which passed on in a former epoch of history can only appear ludicrous to those informed upon the subject or appear to be another case of "the blind leaders of the blind," which latter policy will not endure the test of time, and for which there can be no legitimate excuse in the present day when all information is available.

There is no place in modern orthodontia for appliances which will move teeth over night or for those which pretend to get results automatically with a spectacular flourish. What we do want are mechanical means which are efficient and effective and which work in accordance with Nature's physiological laws. Neither has there ever been an appliance which does not require the

closest application to detail and painstaking care in order to insure the results which we are after.

To advertise a surgeon's knife which would do an appendectomy in the hand of an inexperienced child would deserve no more ridicule than that which is due to an orthodontic appliance for which most remarkable claims are being made. Let us have progress and the goods of merit will not require spectacular advertising to make themselves of service to those who require orthodontic equipment.

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## Pacific Coast Society of Orthodontists

THE fourth annual meeting of the Pacific Coast Society of Orthodontists was held at the Palace Hotel in San Francisco on the twelfth and thirteenth of February. The following program was presented:

Monday, February 12.—President's Address by Dr. James D. McCoy, of Los Angeles; "Recent Developments in Orthodontic Technic," by Dr. A. H. Ketcham, of Denver; "The Possibilities of Systemic Complications During Orthodontic Procedures," by Dr. Julio Endelman, of Los Angeles.

Tuesday, February 13.—"Some Suggestions as to Prophylactic Measures for the Orthodontist," by Dr. D. Arthur Johnston, of Los Angeles; "Artificial Restoration of Missing Teeth Following Orthodontic Procedure," by Dr. C. J. R. Engstrom, of Los Angeles; "A Study of Some Dental Anomalies," by Dr. B. Frank Gray, of Colorado Springs. The following Clinics were given: "The Ribbon Arch and Bracket Attachment," by Dr. A. H. Ketcham, of Denver; "The .0225 Alignment Wire," by Dr. Allen Suggett, of San Francisco; "A Simple and Efficient Attachment for the Bite Plate," by Dr. John R. McCoy, of Los Angeles; "Case Report," by Dr. Robert Dunn, of San Francisco; "Combination Attachment," by Dr. A. A. Solley, of San Francisco; "A Lingual Appliance for the Expansion of Deciduous Arches," by Dr. James D. McCoy, of Los Angeles.

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## Regarding News Items

THE editors of the Journal will be pleased to receive from the members of the profession short news items, change of addresses, "practical pointers," descriptions of new appliances, or any other news that will be of interest to orthodontists, for publication in the columns of this Journal. All such correspondence should be conducted with the publishers and should be addressed to our St. Louis office in the Metropolitan Building.